

Workshop Manual

Octavia II 2004 ➤

Octavia II 2010 ➤

1.4/55; 59 kW MPI engine									
Engine ID	BCA	BUD	CGG A						

Edition 03.2016

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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00 – Technical data

1 Technical data

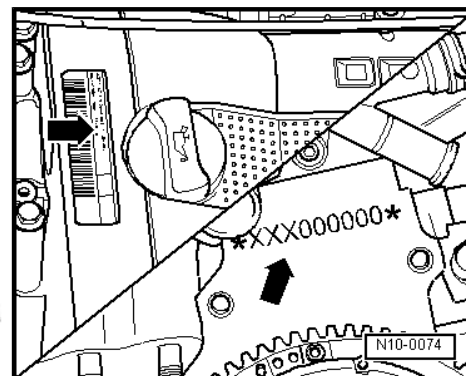
(SRL000929; Edition 03.2016)

1.1 Engine number

The engine number ("engine identification characters" and "serial number") is indicated on the end face of the cylinder block at the gearbox side below the coolant thermostat housing.

In addition, a sticker with the "engine identification characters" and "serial number" is affixed to the timing belt guard.

The engine identification characters are also indicated on the vehicle data sticker.



1.2 Engine characteristics

Engine identification characters	BCA	BUD	CGGA
Manufactured	05.04 ➤ 05.06	06.06 ➤	11.10 ➤
Exhaust limit values conforming to	EU-4	EU-4	EU-5
Displacement cm ³	1390	1390	1390
Power output kW at rpm	55/5000	59/5000	59/5000
Torque Nm at rpm	126/3300	132/3800	132/3800
Bore Ø mm	76.5	76.5	76.5
Stroke mm	75.6	75.6	75.6
Compression ratio	10.5 : 1	10.5 : 1	10.5 : 1
Cylinder / valves per cylinder	4/4	4/4	4/4
Fuel - RON min.	unleaded 95 ¹⁾	unleaded 95 ¹⁾	unleaded 95 ¹⁾
Ignition system, fuel injection	Motronic ME 7.5.10	Magneti Marelli 4HV	Magneti Marelli 4HV
Firing order	1-3-4-2	1-3-4-2	1-3-4-2
Knock control	yes	yes	yes
Self-diagnosis	yes	yes	yes
Lambda control	yes	yes	yes
Catalytic converter	yes	yes	yes
Balancing shaft module	no	no	no
Exhaust gas recirculation	yes	no	no

¹⁾ At least 91 RON in exceptional cases, although engine output is reduced



01 – Self-diagnosis

1 Self diagnosis, safety measures, cleanliness regulations, directions

1.1 Self-diagnosis

This Rep.-Gr. is deleted.

For this use the "Vehicle self-diagnosis", "Measuring method" and "Fault finding" ⇒ Vehicle diagnostic tester.

1.2 Safety precautions when working on the fuel supply system



WARNING

When undertaking all assembly work, particularly in the engine compartment due to its cramped construction, please observe the following:

- ◆ Lay lines of all kinds (e.g. for fuel, hydraulic fluid, the active charcoal container-unit, cooling fluid and refrigerant, brake fluid, vacuum) and electrical lines in such a way that the original line guide is re-established.
- ◆ Ensure that there is adequate free access to all moving or hot components.

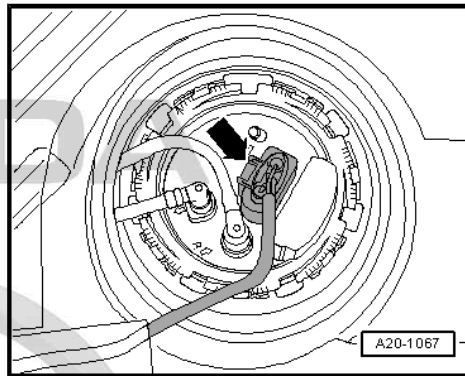
- ◆ Fuel pump is activated by switching on ignition and via driver door contact switch. Before opening the fuel system and for reasons of safety, if the battery is not disconnected, the connector -arrow- must be disconnected from the fuel delivery unit.

When removing and installing the fuel gauge sender or the fuel delivery unit from a full or partly filled fuel tank, pay attention to the following points:



WARNING

The fuel system is under pressure! Place a clean cleaning cloth around the connection point before detaching hose connections. Reduce pressure by carefully removing the hose.



- ◆ The extraction hose of an exhaust extraction system which is switched on, must be positioned close to the assembly opening of the fuel tank in order to extract the released fuel vapours, even before the work is commenced. If no exhaust extraction system is available, a radial fan (motor not in air flow of fan) with a delivery volume of more than 15 m³/h must be used.
- ◆ Avoid skin contact with fuel! Wear fuel-resistant gloves!

1.3 Rules of cleanliness to observe when working on the fuel supply system

Carefully observe the following 5 rules for cleanliness when working on the fuel supply/injection system:

- ◆ Thoroughly clean the connection points and their surroundings before releasing.
- ◆ Place removed parts on a clean surface and cover. Do not use fuzzy cloths!
- ◆ Carefully cover or seal opened or removed components if the repair is not carried out immediately.
- ◆ Only install clean parts: Only unpack replacement parts immediately prior to fitting. Do not use any parts which have been stored unwrapped (e.g. in tool boxes).
- ◆ When the system is open: Avoid using compressed air whenever possible. Avoid moving the vehicle.

1.4 Safety measures to apply when working on the fuel injection and ignition system



WARNING

The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.

Observe the following points to prevent injury to persons and/or damage to the injection and ignition system:

- ◆ Do not touch or remove ignition leads with the engine running or at start speed.
- ◆ Ignition must be switched off before disconnecting and re-connecting the cables of the fuel injection and the ignition system as well as of the test equipment.
- ◆ If the engine must be operated at start speed without it starting, as for example, when checking the compression pressure, remove the fuse for the voltage supply of the injection valves and the ignition coils from the fuse holder ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If test and measuring devices are required during test drives observe the following:

- ◆ Always secure the test and measuring devices on the rear seat and have a second person operate them there.
- ◆ If the test and measuring devices are operated from the front passenger seat, the passenger could be injured by the release of the front passenger airbag in the event of an accident.

1.5 General notes on the injection system

Repairing ignition ⇒ [page 132](#)

- ◆ The engine control unit is equipped with self-diagnosis. Before repairs and also for fault finding, first of all interrogate the event memory. Also check the vacuum hoses and connections (unmetered air).
- ◆ Fuel hoses in the engine compartment must be secured with spring band clamps. The use of clamp-type or screw-type clips is not allowed.
- ◆ A minimum voltage of 11.5 V is required for perfect functioning of the electrical components.
- ◆ Do not use sealants containing silicone. Traces of silicone elements drawn in by the engine are not burnt in the engine and damage the lambda probe.



- ◆ Certain inspections may cause the control unit to detect and store a fault. It is therefore necessary to interrogate the event memory after having completed all inspections and repairs, and if necessary delete ⇒ Vehicle diagnostic tester.

Safety measures ⇒ [page 3](#)

1.6 General notes on the ignition system

- ◆ Switch off the ignition before disconnecting and connecting the battery, as this may damage the 4AV control unit.
- ◆ The engine control unit and further components are equipped with self-diagnosis; inspect ⇒ Vehicle diagnostic tester.
- ◆ A minimum voltage of 11.5 V is required for perfect functioning of the electrical components.
- ◆ Certain inspections may cause the control unit to detect and store a fault. It is therefore necessary to interrogate the event memory after having completed all inspections and repairs, and if necessary delete ⇒ Vehicle diagnostic tester.

Safety measures ⇒ [page 3](#)

Setting data, spark plugs ⇒ Maintenance ; Booklet Octavia II.

1.7 Additional instructions when undertaking assembly work on the air-conditioning system



WARNING

Do not open the refrigerant circuit of the air conditioning system.

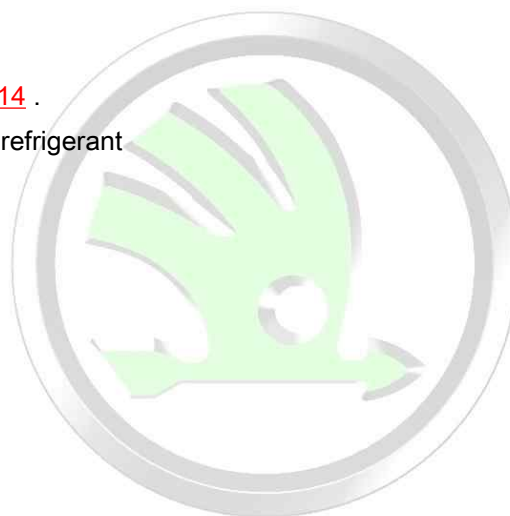


Note

In order to avoid damage to the condenser as well as to the refrigerant lines and hoses, ensure that the lines and hoses are not over-tensioned, kinked or bent.

Steps which should be taken in order to remove and install the engine without opening the refrigerant circuit:

- Remove the holding clamp(s) of the coolant lines.
- Remove the air conditioning compressor ⇒ [page 14](#) .
- Mount the AC compressor in such a way that the refrigerant lines/hoses are not under tension.



10 – Removing and installing engine

1 Removing and installing engine

Special tools and workshop equipment required

- ◆ Lifting device for workshop crane - MP9-201 (2024 A)-
- ◆ Workshop crane, e.g. - V.A.G 1202 A-
- ◆ Catch pan, e.g. - V. A. G. 1306-
- ◆ Pliers for spring strap clamps
- ◆ Assembly stand - MP9-101-
- ◆ Grease - G 000 100-

1.1 Removing



Note

- ◆ *The engine is removed towards the front together with the gearbox.*
- ◆ *All cable straps that have been loosened or cut open when the engine was removed must be attached again in the same location when the engine is installed again.*
- Observe supplementary instructions and assembly work
⇒ [page 2](#).
- Remove the bonnet ⇒ Body Work - Assembly work; Rep. gr. 55.
- Put lock carrier in service position ⇒ Body Work; Rep. gr. 50.

For engine with identification characters BCA

- Remove engine cover with air filter ⇒ [page 114](#).
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Continued for all vehicles

- Disconnect the earth strap from the battery with the ignition off.
- Remove battery and battery tray ⇒ Electrical System; Rep. gr. 27.



WARNING

Observe measures when disconnecting the battery ⇒ Electrical System; Rep. gr. 27.

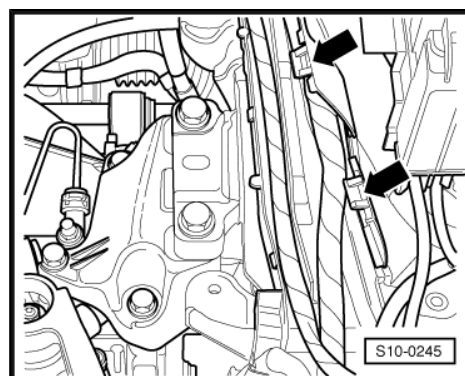
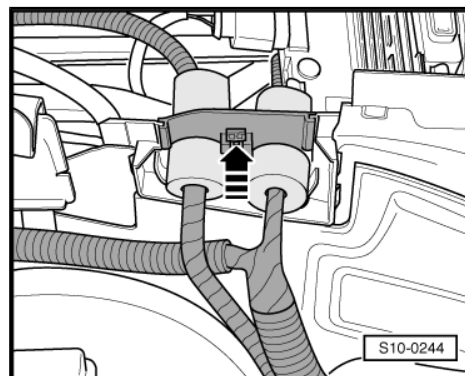
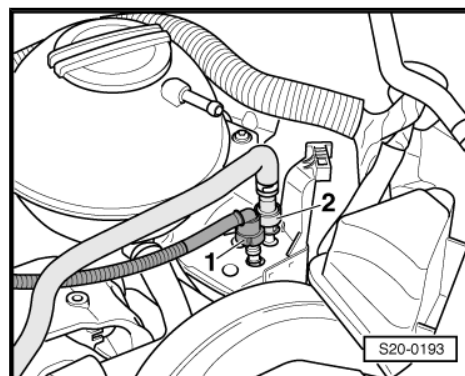


WARNING

Hot steam or hot coolant may escape when the compensation bottle is opened. Cover the cap with a cloth and open carefully.

- Open the cap of the coolant expansion reservoir.
- Remove the sound dampening system ⇒ Body Work; Rep. gr. 50.

- Separate plug connection at coolant temperature sender at radiator outlet - G83- or at thermo-switch for radiator fan - F18- .
- Drain coolant ⇒ [page 74](#) .
- Detach coolant hoses at radiator and at heat exchanger.
- Disconnect hose from solenoid valve 1 -N80- at intake manifold.
- Disconnect the fuel feed line -2- and the vent line -1-. To do so press on the release button.
- Seal the lines so that no dirt can get into the fuel system.
- Disconnect the vacuum and bleeder hoses from the engine.
- Disconnect plug from radiator fan.
- Remove the cooling water tank cover ⇒ Body Work; Rep. gr. 66 .
- Remove the engine control unit ⇒ [page 123](#) .
- Only separate the plug connection for engine wiring harness.
- Release guide for engine wiring harness -arrow- and pull out upwards.



- Open all fuses for lines at frame side rail -arrows-.
- Remove wiring loom from engine control unit.
- Attach wiring loom at engine with cable strap.
- Remove all other necessary electrical cables from the engine and expose them.
- Remove exhaust pipe.
- ♦ Engine identification characters BCA ⇒ [page 125](#)
- ♦ Engine identification characters BUD, CGGA ⇒ [page 127](#)

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- Unbolt the pendulum support -arrows-.
- Unscrew shift mechanism from gearbox ⇒ Gearbox; Rep. gr. 34 .
- Remove slave cylinder ⇒ Gearbox; Rep. gr. 30 .



Note

Do not depress the clutch pedal.

Vehicles with air conditioning

- Remove V-ribbed belt ⇒ [page 15](#) .
- Disconnect plug -1- for regulating valve at AC compressor.



WARNING

Risk of injury through refrigerant.

- ◆ *Do not open the refrigerant circuit of the air conditioning system.*



Caution

Risk of damaging refrigerant lines and hoses.

- ◆ *Do not twist and kink the refrigerant lines and hoses.*

- Release screws -arrows- for AC compressor.
- Attach AC compressor to lock carrier.

Continued for all vehicles

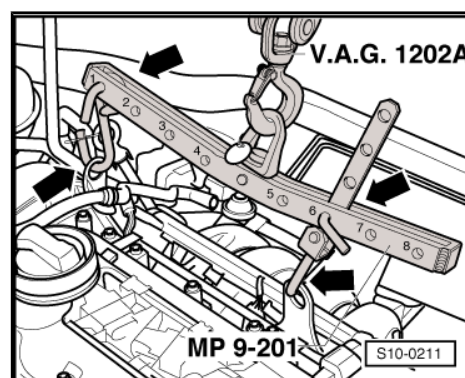
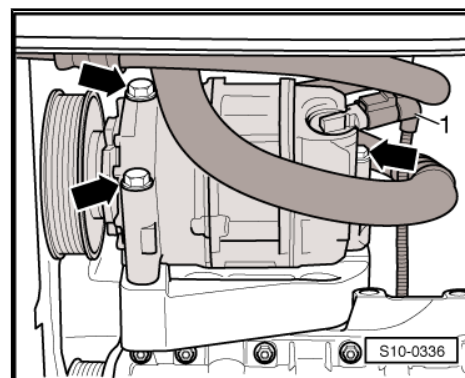
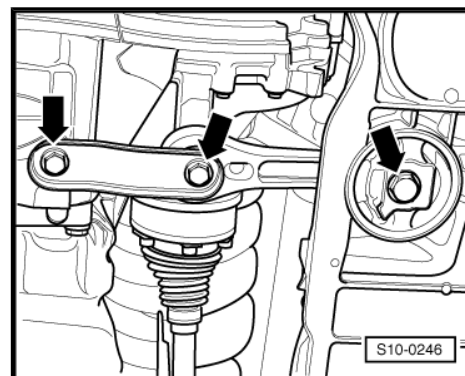
- Remove drive shaft to the right and left of the gearbox and tie up ⇒ Chassis; Rep. gr. 40 .
- Hook on lifting device for workshop crane - MP9-201 (2024 A)- as follows and slightly raise engine with the workshop crane .



WARNING

Secure the hook and the locating pin with locking pins -arrows-.

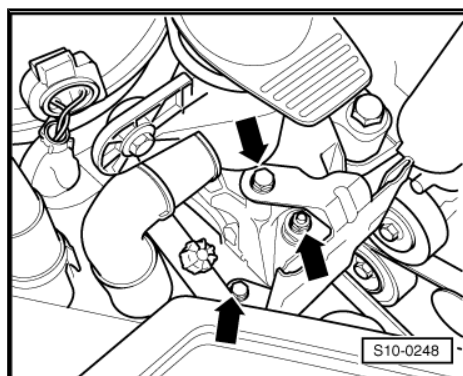
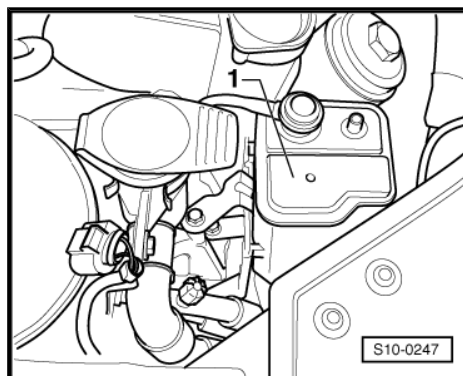
- Disconnect hose from solenoid valve 1 - N80- at activated charcoal filter.



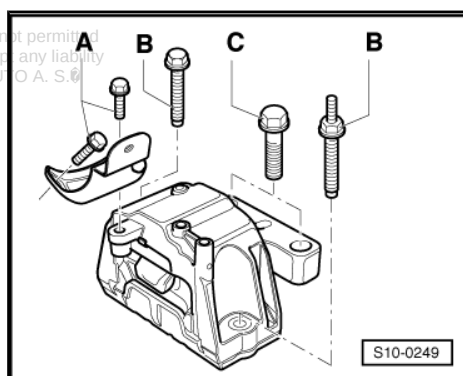
- Remove activated charcoal filter -1- from holder.
- Unscrew the filler neck of the windscreen washer reservoir.

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- Unbolt bracket for activated charcoal filter from engine mounting -arrows-.
- Unscrew the coolant expansion reservoir and lay to the side. (Hoses remain connected).



- Unscrew fixing screws -A-, -B- and -C- for assembly bracket on belt pulley side and remove the assembly bracket completely.

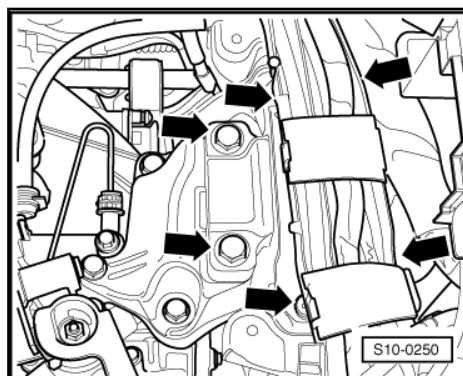


- Unscrew unit from gearbox mount -arrows- and remove.
- Lift unit to the top.



Note

The unit must be guided carefully when being lifted out in order to avoid damaging the vehicle body.



1.1.1 Securing the engine to the assembly stand

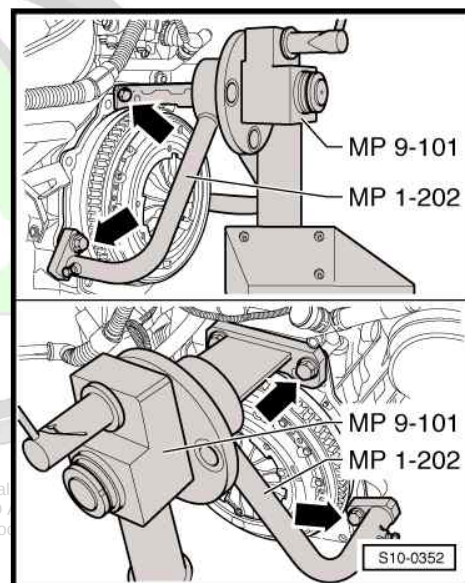
Special tools and workshop equipment required

- ♦ Lifting device - MP9-201 (2024 A)-
- ♦ Engine mount - MP 1-202-
- ♦ Assembly stand - MP 9-101-

- ◆ Workshop crane , e.g. -VAS 6100-

Secure the engine with engine mount - MP 1-202- on the assembly stand - MP 9-101- before performing assembly work.

- Unbolt gearbox from engine ⇒ Gearbox; Rep. gr. 34 .
- Remove coolant regulator housing from the cylinder head.
- Screw engine mount - MP 1-202- to engine and secure to the assembly stand - MP 9-101- .



1.2 Install

Installation is performed in the reverse order, pay attention to the following points:



Note

- ◆ *When performing installation work replace the self-locking nuts.*
- ◆ *Replace screws which have been tightened to a torquing angle as well as gasket rings and seals.*
- ◆ *All cable straps should be fastened again in the same place when installing.*
- ◆ *Secure all hose connections with corresponding hose clips.*
- ◆ *Clean the drive shaft serration and hub serration on used clutch discs, remove corrosion. Apply a very thin layer of grease - G 000 100- onto the serration. Subsequently move the clutch disc up and down on the drive shaft until the hub fits smoothly on the shaft. Remove all excess grease.*
- Inspect clutch release bearing for wear, replace if necessary.
- Slightly grease the clutch release bearing, guide bushing for clutch release bearing and serration of the drive shaft with grease -G 000 100- .
- Check whether the dowel sleeves for centering the engine/ gearbox are present in the cylinder block; insert if necessary.



- Insert intermediate plate and push onto the dowel sleeves -arrows-.
- When swiveling the unit, ensure clearance to drive shafts.
- Align the engine mounting so that it is stress-free through tapping movements.



Note

Tightening torques of the unit mounting ⇒ [page 11](#) .

- Install drive shafts ⇒ Chassis; Rep. gr. 40 .

Vehicles with air conditioning

- Install AC compressor ⇒ [page 14](#) .
- Install the V-ribbed belt ⇒ [page 15](#) .

Continued for all vehicles

- Electrical connections and proper routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install slave cylinder ⇒ Gearbox; Rep. gr. 30 .
- Attach shift mechanism ⇒ Gearbox; Rep. gr. 34 .
- To facilitate the positioning of the generator, drive the bushings for the fixing screws slightly backwards
- Install the noise insulation ⇒ Body Work; Rep. gr. 50 .
- Connect coolant hoses at radiator and at heat exchanger.
- Top up coolant ⇒ [page 74](#) .

For engine with identification characters BCA

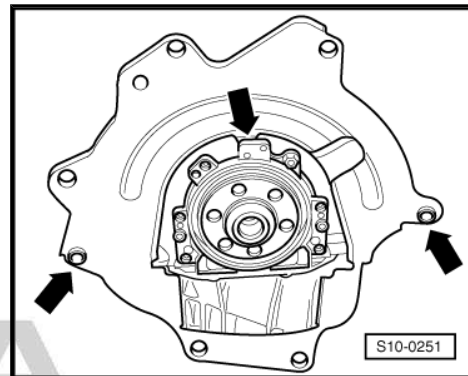
- Install engine cover with air filter ⇒ [page 114](#) .
- On vehicles up to 05/2005, adapt the engine control unit to the EGR valve ⇒ Vehicle diagnostic tester.

Continued for all vehicles

- Adapt the engine control unit to the throttle valve control unit ⇒ Vehicle diagnostic tester.
- Perform a test drive and query event memory ⇒ Vehicle diagnostic tester.

Tightening torques

Component		Nm
Screws/nuts	M6	9
	M7	13
	M8	20
	M10	40
	M12	70
In variation of this:		
Screws for assembly bracket		⇒ page 11
Engine/gearbox connecting screws ⇒ Gearbox; Rep. gr. 34		



1.3 Assembly bracket

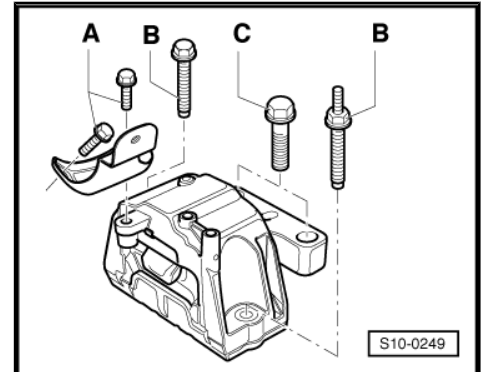
1.3.1 Tightening torques

Assembly bracket - engine

A - 20 Nm + 90° (1/4 turn) - replace

B - 40 Nm + 90° (1/4 turn) - replace

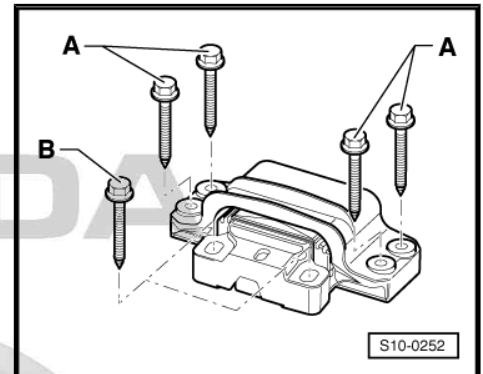
C - 60 Nm + 90° (1/4 turn) - replace



Assembly bracket - gearbox

A - 40 Nm + 90° (1/4 turn) - replace

B - 60 Nm + 90° (1/4 turn) - replace



Pendulum support

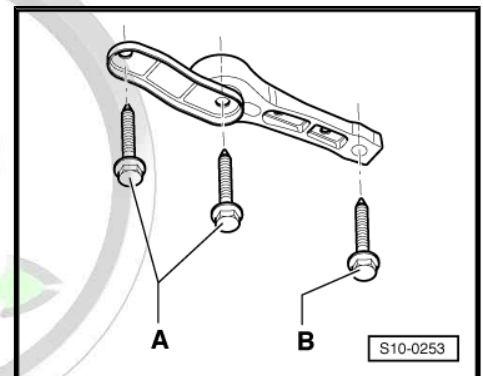
Screw -A- strength category 8.8 = 40 Nm + torque a further 90° (1/4 turn) - replace

Screw -A- strength category 10.9 = 50 Nm + torque a further 90° (1/4 turn) - replace

Screw -B- = 100 Nm + torque a further 90° (1/4 turn) - replace

Removing: First unscrew screw -B-, then screw -A-.

Installing: First tighten screw -A-, then screw -B-.



1.3.2 Checking the assembly bracket

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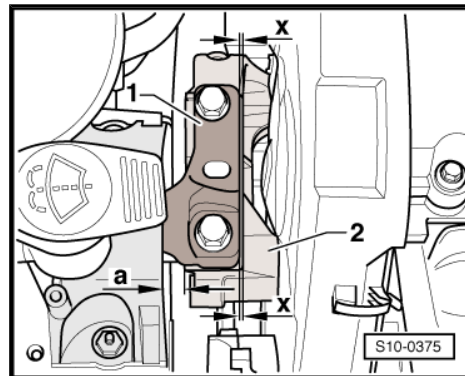


- Check dimensions on the right hanger for engine/gearbox unit:
- Between engine bracket and engine support there must be a distance -a- = 10 mm.
- The cast iron edge on the engine support -2- must be parallel to the supporting arm -1- the dimension -x- must be the same at the front and rear.



Note

The distance -a- can be checked, for example with suitable round bars.



Only if there is an acoustic complaint (engine or gearbox knock on the frame side rail when cornering) and the dimension -a- is not 10 mm:

- Adjust the assembly bracket ⇒ [page 12](#) .

1.3.3 Adjusting the unit mounting

Special tools and workshop equipment required

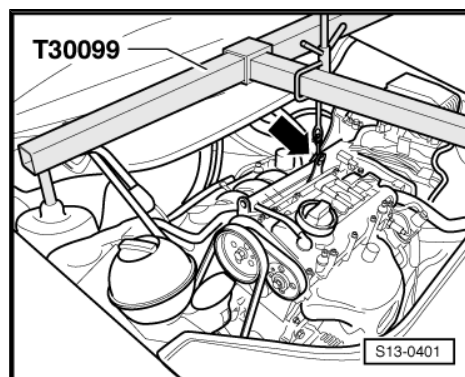
- ◆ Supporting device - T30099-
- ◆ Base - T30099/1-
- ◆ Snap hook
- Remove battery and battery tray ⇒ Electrical System; Rep. gr. 27 .
- Remove the cooling water tank cover ⇒ Body Work; Rep. gr. 66 .

For engine with identification characters BCA

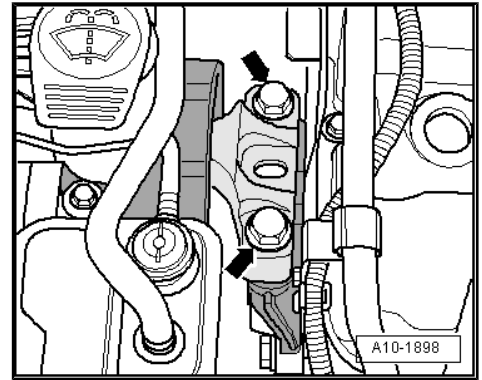
- Remove engine cover with air filter ⇒ [page 114](#) .

Continued for all vehicles

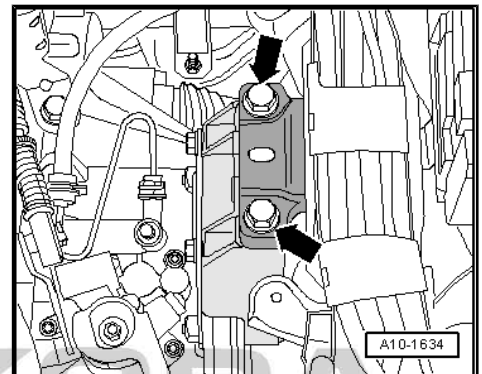
- Position the supporting device - T30099- with base - T30099/1- and secure the engine on the lifting eye -arrow- at the cylinder head in the fitting position.
- Pre-tension the engine/gearbox unit with spindle, but do not raise.



- Release the screws -arrows- of the assembly bracket at the engine.



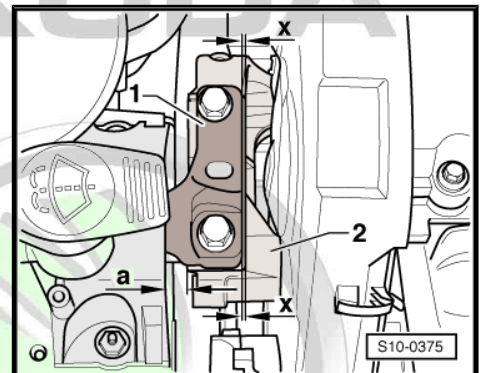
- Slightly loosen the screws -arrows- of the assembly bracket at the gearbox (less than 1 revolution).
- Successively replace all the screws of the assembly bracket (as long as it has not already been performed when installing the engine) and insert these loosely.



- Move the engine/gearbox assembly with an assembly lever between engine support -2- and supporting arm -1- for engine mount until the following dimensions are set:
 - Between engine bracket and engine support there must be a distance -a- of 10 mm.
 - The cast iron edge on the engine support -2- must be parallel to the supporting arm -1- the dimension -x- must be the same at the front and rear.

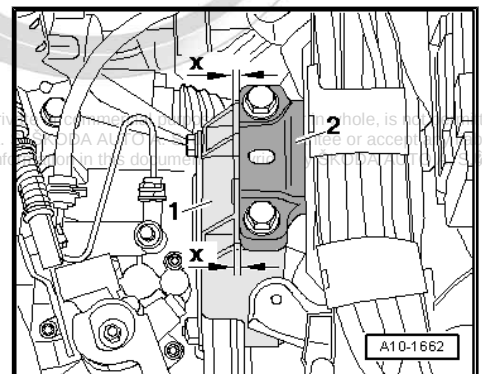
i Note

The distance -a- = 10 mm can be checked e.g. with suitable round bars.



- Tighten the screws for the engine side assembly bracket
⇒ [page 11](#) .
- Make sure that on the gearbox side the edges of the supporting arm -2- and gearbox support -1- are parallel.
 - The dimension -x- must be the same on both mount sides.
- Tighten the screws for the gearbox side assembly bracket
⇒ [page 11](#) .

Further installation occurs in reverse order.



13 – Crankshaft group

1 Disassembling and assembling engine

1.1 V-ribbed belt drive - Summary of components

1 - Tensioning pulley for ribbed V-belt

- ☐ Swing out the tensioning pulley with a ring spanner
- ☐ The tensioning pulley can be secured by inserting the socket wrench into the fit hole

2 - Bracket for auxiliary units

3 - 50 Nm

- ☐ Tightening sequence: Tighten first top right bolt, then bottom right bolt, and last the bolts at the left (looking in direction of travel)

4 - 23 Nm

5 - Generator

- ☐ removing and installing ⇒ Electrical System; Rep. gr. 27
- ☐ to facilitate the positioning of the generator, drive the threaded bushings for fixing screws at the generator slightly backwards

6 - Screw

- ☐ M8: Turn a further 20 Nm + 1/4 turns (90°).
- ☐ M10: 45 Nm

7 - Bushing

- ☐ 2 pieces

8 - 25 Nm

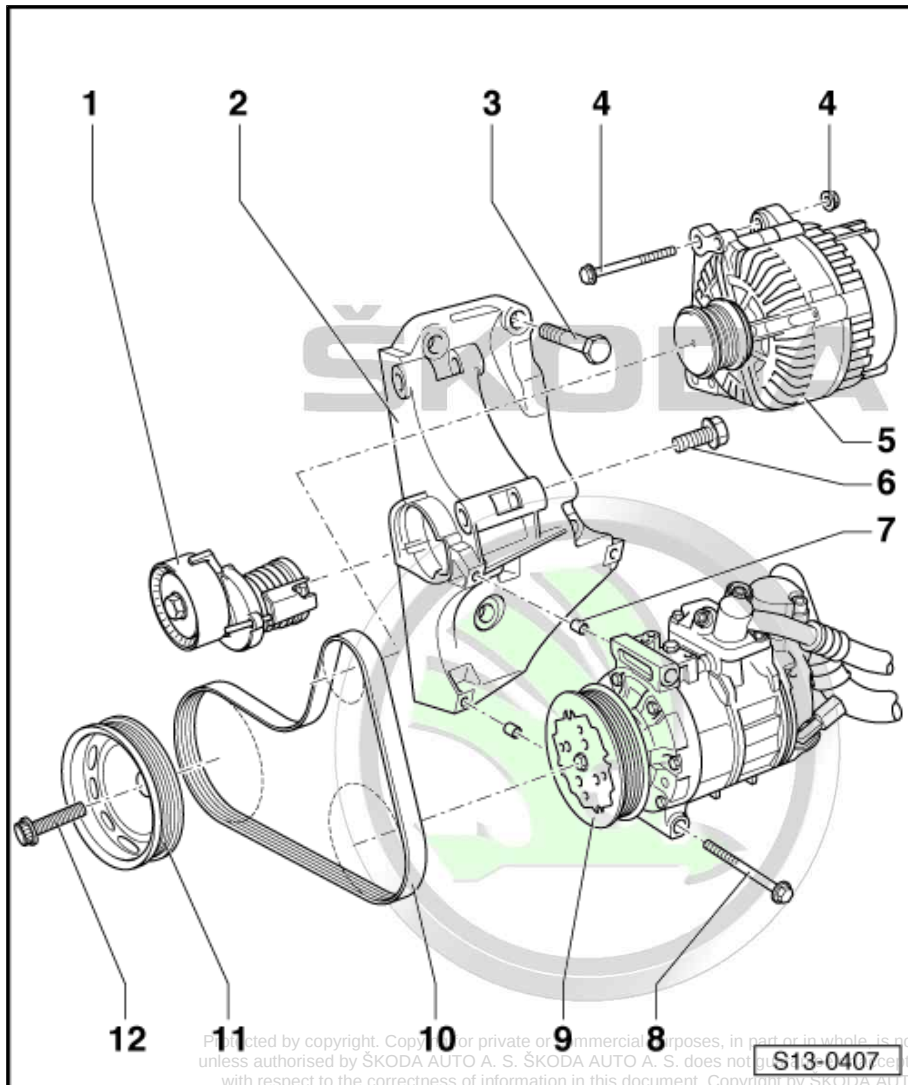
9 - AC compressor

10 - V-ribbed belt

- ☐ mark the direction of rotation with chalk or a felt-tip pen before removing
- ☐ check for wear
- ☐ removing and installing ⇒ [page 15](#)
- ☐ Routing of the ribbed V-belt ⇒ [page 15](#)

11 - Belt pulley

- ☐ for the V-ribbed belt



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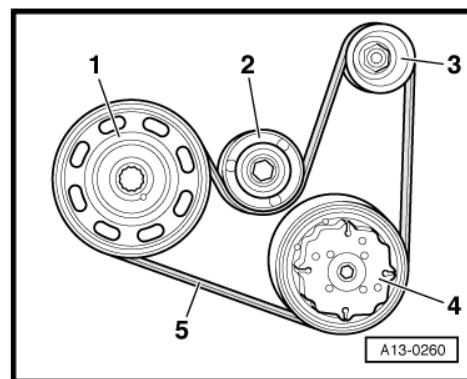
S13-0407

12 - Turn a further 150 Nm + 1/2 turns (180°).

- ☐ replace
- ☐ The contact surfaces of the fixing screw and the belt pulley must be free of grease and oil
- ☐ Oil the thread of the screw
- ☐ Counterhold belt pulley with counterholder - T30004 (3415)- with bolt -T30004/1 (3415/1)-
- ☐ tightening may occur in successive stages
- ☐ the torquing angle can be measured with a commercially available angle measuring plate, e.g. -Hazet 6690-

Routing of the V-ribbed belt with AC compressor

- 1 - Vibration damper
- 2 - Tensioning pulley
- 3 - Belt pulley for AC generator
- 4 - AC compressor
- 5 - V-ribbed belt



1.2 Removing and installing V-ribbed belt

Special tools and workshop equipment required

- ◆ Clamping lever - MP1-203-
- ◆ Open-end wrench 16
- ◆ Locking pin - T10060A-

Vehicles without air conditioning

Removing

- Remove the noise insulation.
- Remove front wheelhouse liner: ⇒ Body Work; Rep. gr. 66 .
- Mark the rotation direction of the V-ribbed belt.
- Release fixing screws for generator.



- Position clamping lever - MP1-203- , secure by inserting the pin and and press generator towards the crankshaft.

Remove the released V-ribbed belt from the generator - belt pulley.

Install

- Lay the V-ribbed belt on the vibration damper.
- Push AC generator down and fit on belt.

Once the generator is released the belt is tensioned to nominal voltage.

- After fitting the V-ribbed belt, crank the engine several times with the starter (about 10 turns) once the generator screws are released.
- First tighten the bottom and then the top screw for AC generator to 20 Nm.
- Install the noise insulation.

Vehicles with air conditioning

Removing

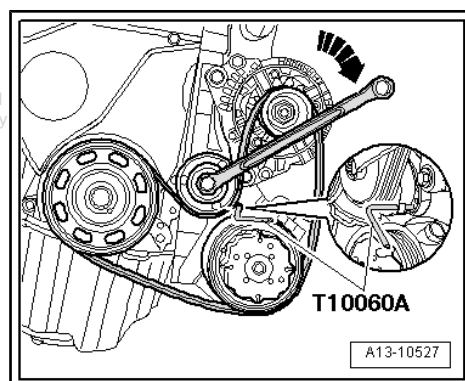
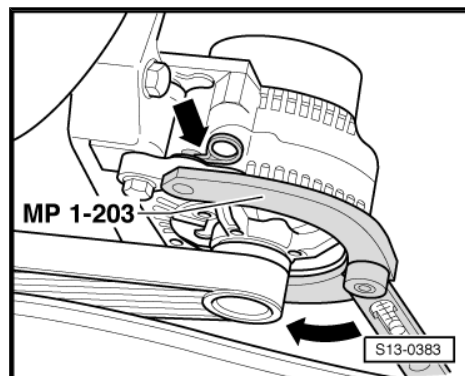
- Remove the noise insulation.
- Remove front wheelhouse liner: ➔ Body Work; Rep. gr. 66 .
- Mark the rotation direction of the V-ribbed belt.

- Swivel out tensioning pulley with a wrench 16 in -direction of arrow-.

- Remove the V-ribbed belt. If necessary the tensioning pulley can be secured by inserting a locking pin - T10060A- or a 4 mm hexagon socket wrench into the fit hole.

Install

- First lay the V-ribbed belt on the vibration damper, then on the AC compressor belt pulley.
- Release tensioning pulley with the wrench and pull the belt over the generator - belt pulley.
- Check whether the ribbed V-belt fits correctly in the ribbing of all tensioning pulleys.
- Check V-ribbed belt when engine is idling.
- Install the noise insulation.



Note

- ♦ Pay attention to the running direction when installing the V-ribbed belt.
- ♦ Replace damaged V-ribbed belt.
- ♦ If the belt is considerably worn it must be replaced.
- ♦ Do not bend or buckle the belt!

1.3 Assembly overview - toothed belt drive

1 - Top toothed belt guard

2 - Turn a further 20 Nm + 1/4 turns (90°).

- ☐ replace
- ☐ to release and tighten use camshaft lock - T10016-

3 - Camshaft sprocket

- ☐ take note of the position when installing the timing belt ➔ [page 19](#)

4 - Coupling drive tensioning pulley

- ☐ check ➔ [page 25](#)
- ☐ Tensioning toothed belt ➔ [page 19](#)

5 - Coupling drive - toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ removing and installing, tensioning ➔ [page 19](#)

6 - Support

- ☐ only mounted for engine identification characters BCA

7 - 10 Nm

8 - Coolant pump

- ☐ replace completely if damaged or leaking
- ☐ removing and installing ➔ [page 79](#)

9 - Rear toothed belt guard

10 - 20 Nm

11 - 50 Nm

12 - Guide pulley

13 - Tensioning pulley

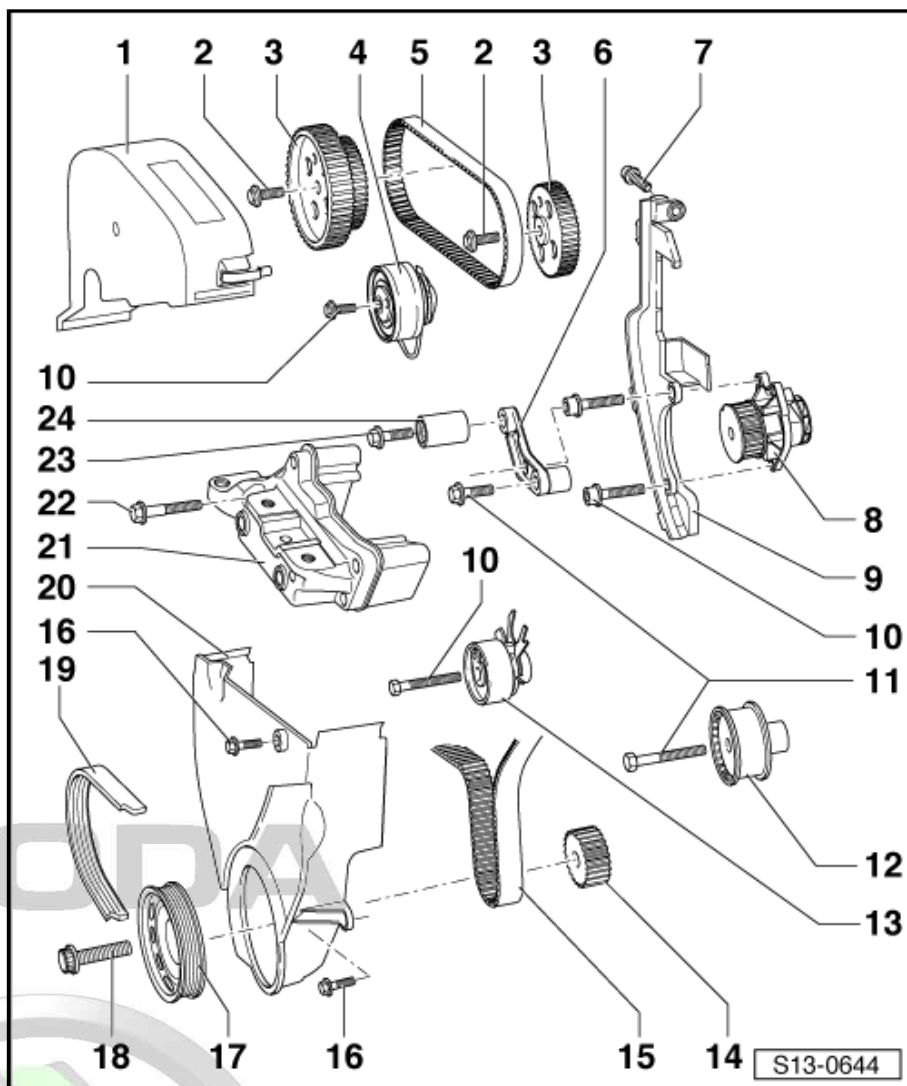
- ☐ check ➔ [page 25](#)
- ☐ Tensioning toothed belt ➔ [page 19](#)

14 - Vibration damper

- ☐ take note of the position when installing the timing belt ➔ [page 19](#)

15 - Main drive toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ Routing of toothed belt ➔ [page 19](#)
- ☐ removing and installing, tensioning ➔ [page 19](#)





Note

If the toothed belt is replaced within the scope of engine repair (apart from change intervals), it should be entered in the Service Schedule!

16 - 12 Nm

- ☐ replace

17 - Belt pulley

- ☐ pay attention to the locating element when installing
- ☐ removing and installing ⇒ [page 19](#)

18 - Turn a further 150 Nm + 1/2 turns (180°).

- ☐ replace
- ☐ The contact surfaces of the fixing screw and the belt pulley must be free of grease and oil
- ☐ Oil the thread of the screw
- ☐ Counterhold belt pulley with counterholder - T30004 (3415)- with bolt -T30004/1 (3415/1)-
- ☐ tightening may occur in successive stages
- ☐ the torquing angle can be measured with a commercially available angle measuring plate, e.g. -Hazet 6690-

19 - V-ribbed belt

- ☐ mark the direction of rotation with chalk or a felt-tip pen before removing
- ☐ check for wear
- ☐ removing and installing ⇒ [page 15](#)
- ☐ Routing of the ribbed V-belt ⇒ [page 15](#)

20 - Timing belt guard - bottom part

21 - Console

22 - 50 Nm

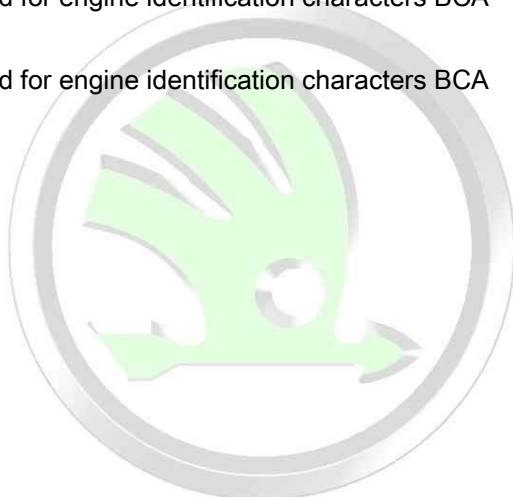
- ☐ replace

23 - 25 Nm

- ☐ only mounted for engine identification characters BCA

24 - Guide pulley

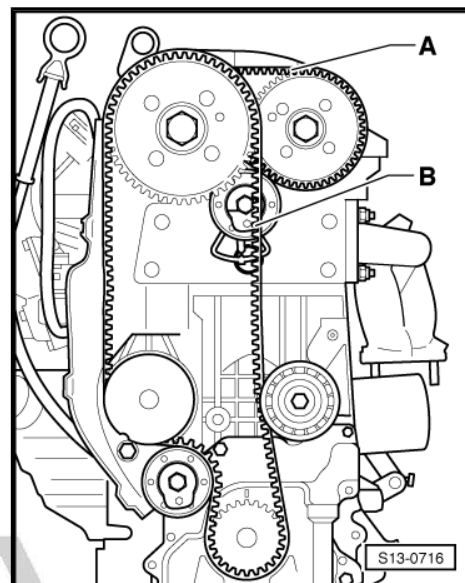
- ☐ only mounted for engine identification characters BCA



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Routing of toothed belt

- A- coupling drive - toothed belt
- B- main drive toothed belt



1.4 Removing and installing, tightening the toothed belt

Special tools and workshop equipment required

- ◆ Supporting device - T30099-
- ◆ Base - T30099/1-
- ◆ Counterholder - T30004- with replaceable bolts -T30004/1-
- ◆ Camshaft clamp - T10016-

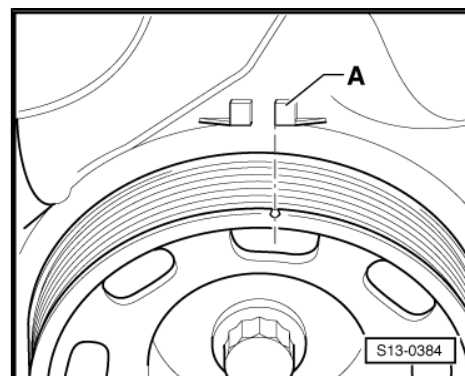
1.4.1 Removing

For engine with identification characters BCA

- Remove engine cover with air filter ➔ [page 114](#) .

Continued for all vehicles

- Remove top toothed belt guard.
- Remove the noise insulation.
- Remove front wheelhouse liner: ➔ Body Work; Rep. gr. 66 .
- Mark the rotation direction of the V-ribbed belt and remove belt ➔ [page 15](#) .
- Position crankshaft on TDC for cylinder 1. The notch on the belt pulley must be aligned with the edge of the marking -A-.





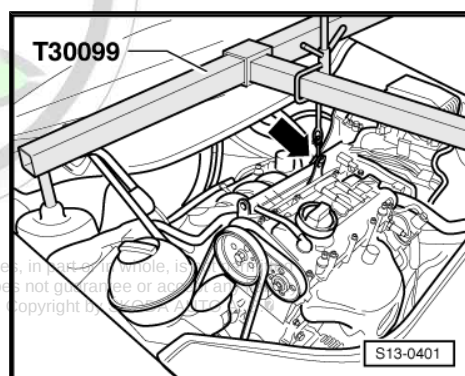
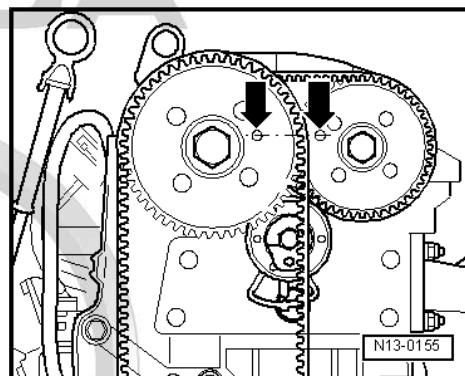
- The locating holes in the camshaft sprockets must be aligned with the fit holes in the camshaft housing -arrows-.



Note

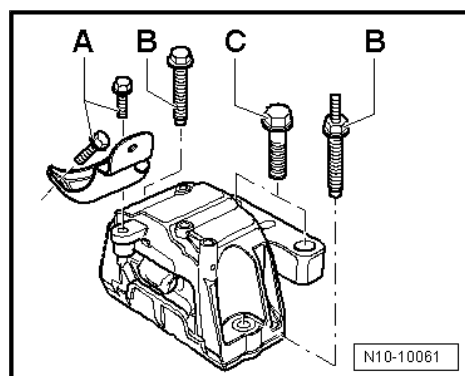
If the locating holes are positioned on the opposite side of the toothed belt sprockets, it will be necessary to rotate the crankshaft a further revolution.

- Remove the cooling water tank cover ⇒ Body Work; Rep. gr. 66 .
- Position the supporting device - T30099- with base - T30099/1- and secure the engine on the lifting eye -arrow- at the cylinder head in the fitting position.
- Remove activated charcoal filter from holder.
- Unscrew the filler neck of the windscreen washer reservoir.
- Unbolt bracket for activated charcoal filter from engine mounting.
- Unscrew the coolant expansion reservoir and lay to the side. (Hoses remain connected).



- Unscrew fixing screws -A-, -B- and -C- for assembly bracket on belt pulley side and remove the assembly bracket completely.
- Remove the engine mount on the cylinder head.
- Mark the rotation direction of the two toothed belts.

Attach the two camshaft sprockets with camshaft lock -T10016- as follows:



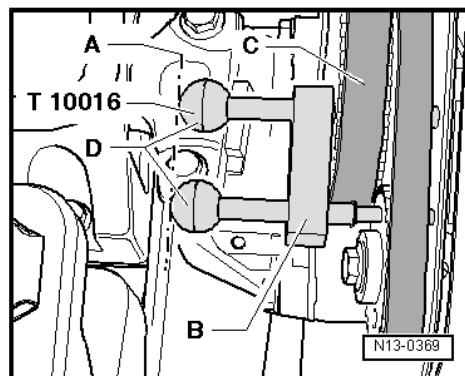
- Insert the two fixing pins through the locating holes of the camshaft sprockets up to the stop in the fit holes in the camshaft housing.



Note

The two fixing pins are correctly inserted if the end parts -D- are flush with line -A-.

- Slide the support -B- up to the stop on the camshaft timing gear -C-.



- Release fixing screw for belt pulley and toothed belt sprocket. Counterhold belt pulley with counterholder - T30004- and bolt - T30004/1- .
- Remove belt pulley. Screw in the fixing screw with two washers to secure the toothed belt sprocket.

Vehicles with air conditioning

- Remove tensioning pulley for V-ribbed belt ➔ [page 14](#) .

For all vehicles

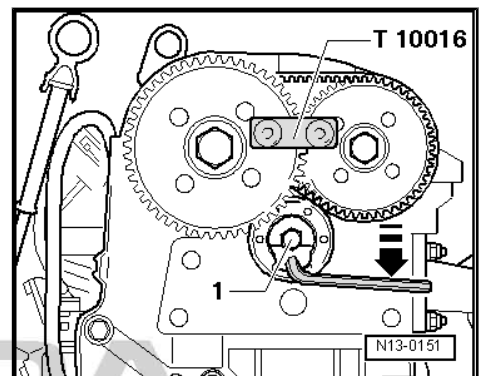
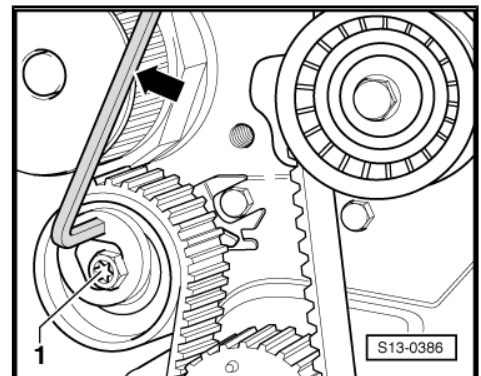
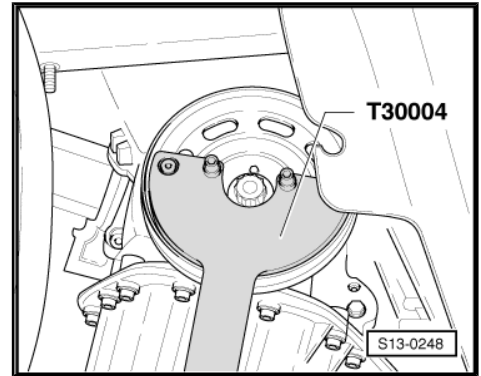
- Remove bottom toothed belt guard.

Remove main drive toothed belt:

- Release the main drive tensioning pulley -1- and release the toothed belt by turning the tensioning pulley anti-clockwise -arrow-.
- Release the tensioning screw of the tensioning pulley.
- Remove tensioning pulley.
- Remove camshaft lock -T10016- .
- Remove timing belt.
- Fix the two camshaft sprockets with camshaft lock -T10016- .

Remove coupling drive - toothed belt:

- Release the coupling drive tensioning pulley -1- and release the toothed belt by turning the tensioning pulley clockwise -arrow-.
- Remove coupling drive tensioning pulley.
- Remove timing belt.



1.4.2 Install

Preconditions:

- No piston must be standing at TDC.
- The crankshaft - toothed belt sprocket is secured to the crankshaft with a fixing screw and two washers.
- Camshaft sprockets are fixed with camshaft lock - T10016- in the fit holes in the camshaft housing and secured against turning.



Note

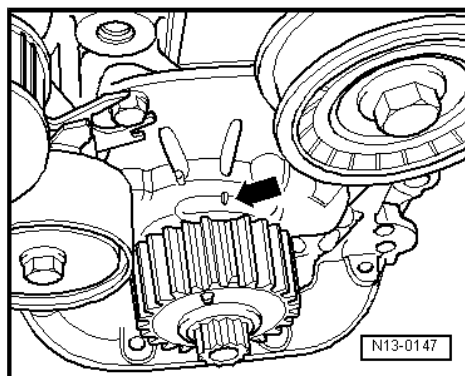
When turning the camshaft the valves may touch the piston in TDC.



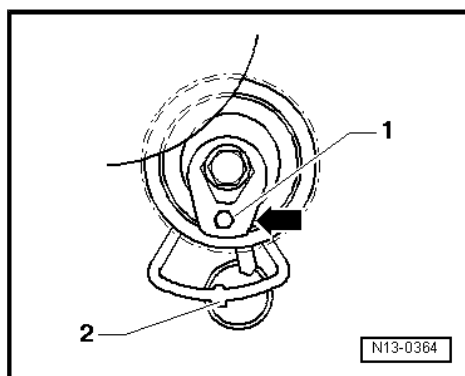
Work procedure

- Position crankshaft on TDC for cylinder 1. The chamfered tooth must correspond with the marking on the sealing flange -arrow-.
- Fit on coupling drive - toothed belt. If the toothed belt has been used pay attention to the rotation direction.

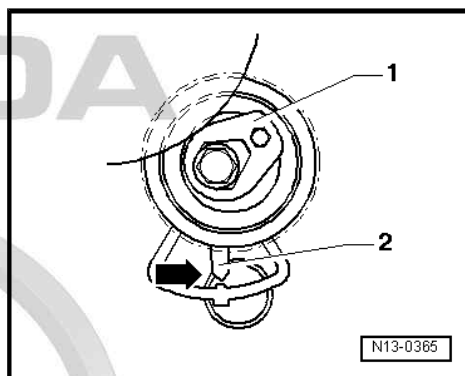
Install the coupling drive tensioning pulley as follows:



- Turn the coupling drive tensioning pulley with Allan screw -1- clockwise in the direction of the marking window -arrow-, (tensioning pulley in released position).
- Push the bottom part of the coupling drive-toothed belt upwards using the tensioning pulley and screw in the fixing screw of the tensioning pulley.
- Tighten fixing screw manually. The peg of the base plate -2- must engage in the bore in the cylinder head.

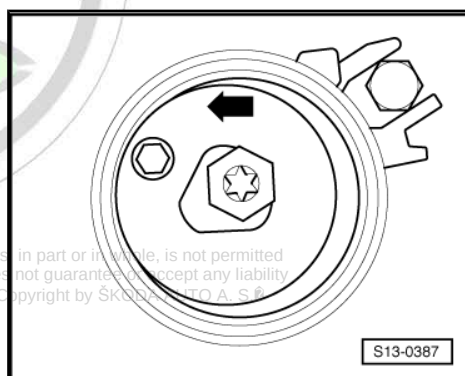


- Subsequently tension the toothed belt by turning the tensioning pulley with an Allan key Pos. -1- anti-clockwise until the pointer -2- is positioned above the peg of the base plate in the marking window -arrow-.
- Tighten the fixing screw on the tensioning pulley. Tightening torque: 20 Nm
- Remove camshaft lock -T10016- .
- Turn the crankshaft or toothed belt gear from TDC half a tooth anti-clockwise (approx 1.5 mm).
- Fit on main drive toothed belt.
- Fix the two camshaft sprockets with camshaft lock -T10016- .



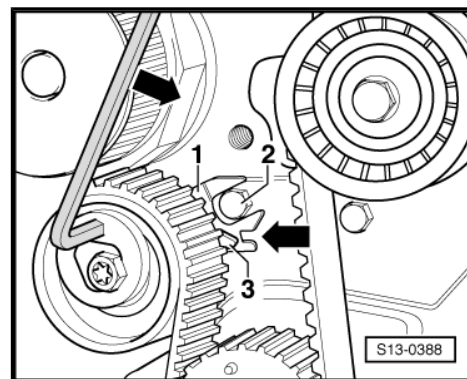
If the tensioning pulley has been removed beforehand, install tensioning pulley as follows:

- Turn tensioning pulley with Allan key anti-clockwise in the marked position -arrow-.



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- Tighten fixing screw manually. The screw in the cylinder block -2- must lock in the recess on the base plate -1-.
- Subsequently tension the toothed belt in the direction of the arrow by turning the tensioning pulley until the pointer -3- is positioned over the notch in the base plate -arrow-.
- Tighten the fixing screw on the tensioning pulley. Tightening torque: 20 Nm
- Remove camshaft lock -T10016- .



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- Now rotate crankshaft two revolutions in direction of rotation of engine until it is again positioned on TDC for cylinder 1. The chamfered tooth must correspond with the marking on the sealing flange -arrow- in the fig. -A-.

In this position both camshaft sprockets must lock with camshaft lock -T10016- fig. -B-.

- Then inspect the toothed belt setting and tensioning pulley setting again, if necessary repeat tensioning of the two toothed belts.
- Install bottom timing belt guard.
- Install the vibration damper. Pay attention to the following:
 - ◆ The fixing screws for the belt pulley and toothed belt gear must be replaced.
 - ◆ Pay attention to the toothed belt gear attachment when installing the belt pulley.
 - ◆ The clamping surfaces of the belt pulley and the screw must be degreased.
 - ◆ Tightening process for newly oiled screw: Turn a further 150 Nm + 1/2 turns (180°).
 - ◆ Counterhold vibration damper with counterholder - T30004 (3415)- with replaceable bolt -T30004/1 (3415/1)- .
- Attach engine mount to cylinder head. Tightening torque 50 Nm
- Install engine assembly bracket. Tightening torques ➔ [page 11](#) .
- Install top toothed belt guard.

Vehicles with air conditioning

- Install tensioning pulley for V-ribbed belt ➔ [page 14](#) .

For all vehicles

- Install the V-ribbed belt ➔ [page 15](#) .



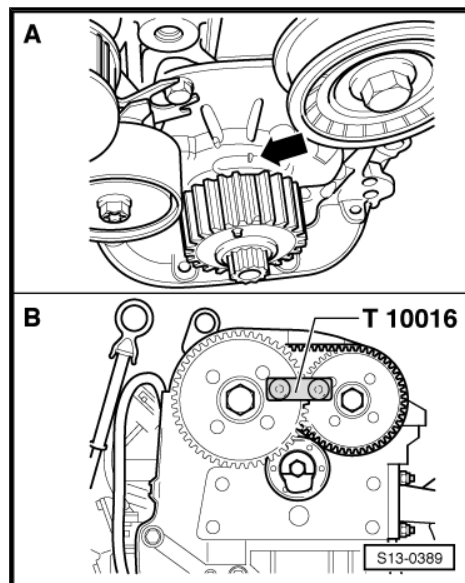
Note

Pay attention to the correct position of the V-ribbed belt in the belt pulley when installing it.

- Install front wheelhouse liner: ➔ Body Work; Rep. gr. 66 .
- Install the noise insulation.
- Screw on the coolant expansion reservoir.
- Install activated charcoal filter ➔ [page 107](#) .

For engine with identification characters BCA

- Install engine cover with air filter ➔ [page 114](#) .



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1.5 Checking semi automatic toothed belt tensioning pulley

Check main drive tensioning pulley:

- Mark the pointer position of the tensioning pulley -arrow-. Load timing belt by firmly pressing down with thumb. The pointer must move.
- Relieve the pressure on the toothed belt and rotate crankshaft a further two revolutions in direction of rotation of engine until the engine is again positioned at TDC of cylinder 1. When doing this, it is important that the last 45° (1/8 turn) are rotated without any interruption.
- Then check pointer position. The pointer must return to its initial position.

If the pointer does not return to its initial position:

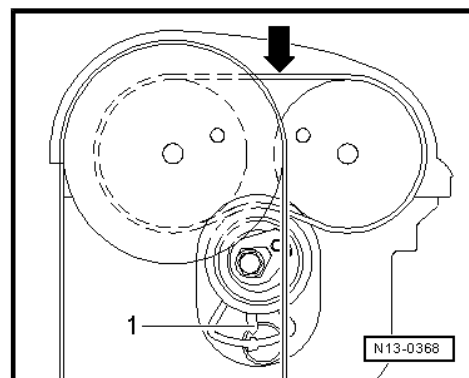
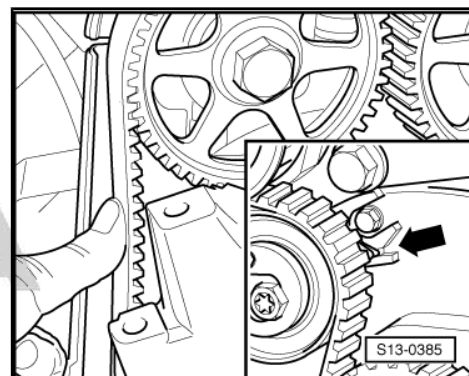
- Replace tensioning pulley.

Check coupling drive tensioning pulley

- Mark the pointer position of the tensioning pulley -1-. Load timing belt by firmly pressing down with thumb -arrows-. The pointer must move.
- Relieve the toothed belt again.
- Turn the crankshaft twice in the running direction of the engine.
- Then check pointer position. The pointer must return to its initial position.

If the pointer does not return to its initial position:

- Replace tensioning pulley.



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2 Removing and installing cylinder block

2.1 Cylinder block made out of aluminium - summary of components



WARNING

The crankshaft must not be removed. Merely loosening the screws of the crankshaft bearing cover will cause deformations of the bearing seats of the cylinder block. These deformations reduce the bearing clearance. Even if the bearing shells were not replaced, the changed bearing clearance may cause damage to the bearing.

If the bearing cap bolts are loosened, the cylinder block must be renewed complete with the crankshaft.

It is not possible to measure the crankshaft bearing clearance under workshop conditions.



Note

Repairing clutch ⇒ Gearbox; Rep. gr. 30

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1 - 10 Nm

2 - Intake manifold

- ☐ for engine identification characters BUD, CGGA
- ☐ Clean strainer if dirty

3 - Intake manifold

- ☐ for engine identification characters BCA
- ☐ Clean strainer if dirty

4 - Cylinder block

5 - Knock sensor

6 - 20 Nm

- ☐ The tightening torque influences the knock sensor function

7 - Turn a further 60 Nm + 1/4 turns (90°).

- ☐ replace

8 - Flywheel

- ☐ lock with counterholder - MP1-223 (3067)- for removing and installing

9 - Intermediate plate

- ☐ must be positioned on dowel sleeves
- ☐ do not damage or bend during assembly work

10 - 12 Nm

- ☐ replace

11 - Sealing flange with rotor and gasket ring

- ☐ always replace complete with gasket ring and rotor
- ☐ removing and installing sealing flange ⇒ [page 28](#)

12 - Engine speed sender - G28-

- ☐ removing and installing ⇒ [page 117](#)

13 - 5 Nm

14 - Gasket

- ☐ replace

15 - Oil pump

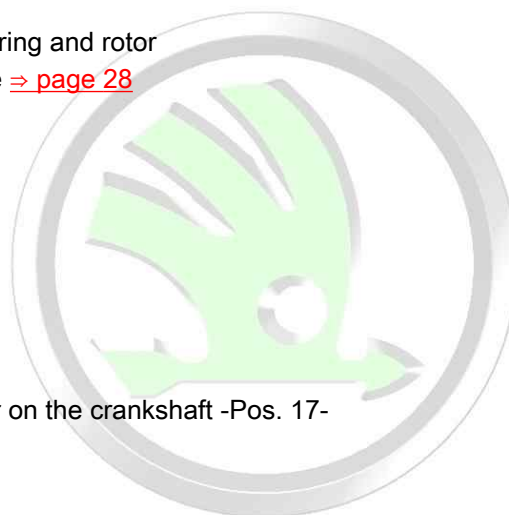
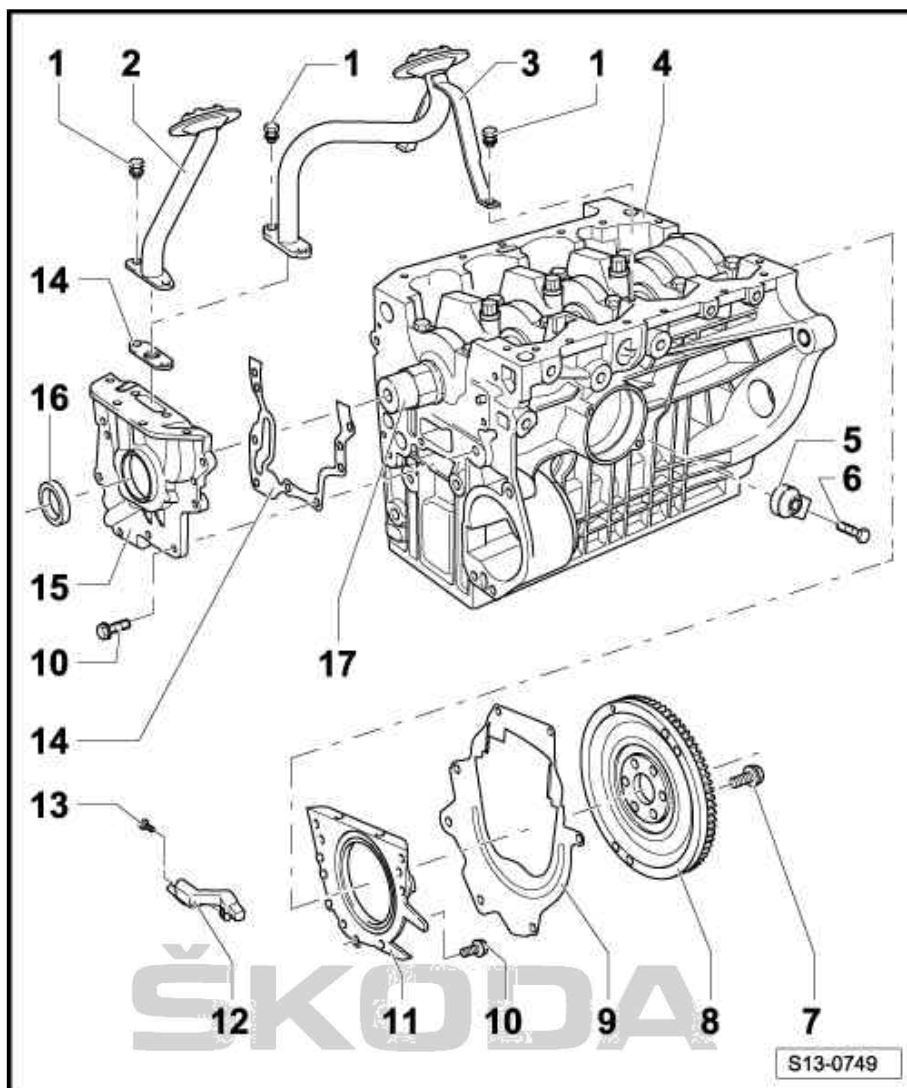
- ☐ must be replaced completely
- ☐ when fitting pay attention to the driver on the crankshaft -Pos. 17-
- ☐ must be positioned on dowel sleeves
- ☐ removing and installing ⇒ [page 65](#)

16 - Sealing ring

- ☐ replace ⇒ [page 28](#)

17 - Driver

- ☐ coat with oil before installing the oil pump



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2.2 Replacing crankshaft seal on belt pulley side

Special tools and workshop equipment required

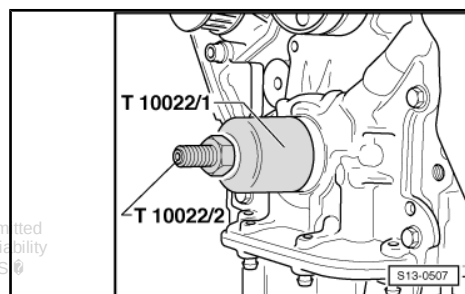
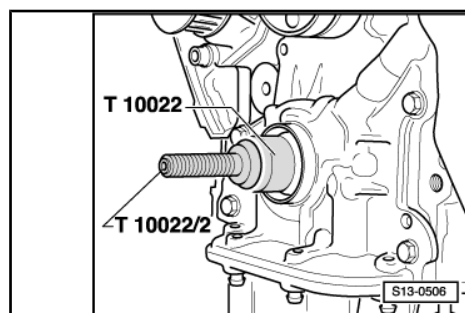
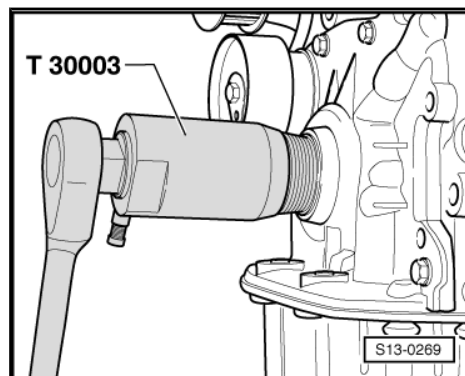
- ◆ Gasket ring extractor - T30003 (3240)-
- ◆ Socket - T10022-
- ◆ Thrust piece - T10022/1-
- ◆ Spindle - T10022/2-

Removing

- Remove main drive toothed belt ➔ [page 19](#) .
- Remove crankshaft - toothed belt sprocket.
- To guide the gasket ring extractor screw in fixing screw for toothed belt gear in the crankshaft up to the stop.
- Unscrew inner part of the gasket ring extractor -T30003- two turns (approx. 3 mm) out of the outer part and lock with knurled screw.
- Oil the thread head of the gasket ring extractor, position and forcibly screw into the gasket ring as far as possible.
- Release knurled screw and turn the inner side against the crankshaft until the gasket ring is pulled out.

Install

- Lightly oil the sealing lip of the gasket ring.
- Position the assembly device - T10022- on the crankshaft stub and screw in with spindle -T10022/2- up to the stop.
- Slide gasket ring over the assembly device -T10022- .
- Press in gasket ring with pressure plate -T10022/1- up to the stop.
- Install the main drive toothed belt ➔ [page 21](#) .



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2.3 Replacing the sealing flange for the crankshaft on the flywheel side

Special tools and workshop equipment required

- ◆ Assembly tool - T10134-

- ◆ 3 hexagon screws M6x35 mm
- ◆ Feeler gauge
- ◆ Steel straightedge

2.3.1 Removing sealing flange with rotor



Note

In order to better represent the work sequences, these sequences are performed with the engine removed. The work sequences are identical with the engine installed and gearbox removed.

- Remove the flywheel.
- Remove the intermediate plate.
- Position engine on TDC cylinder 1 ➤ [page 19](#) .
- Removing the oil pan ➤ [page 63](#) .
- Remove engine speed sender -arrow-.
- Unscrew fixing screws on the sealing flange.

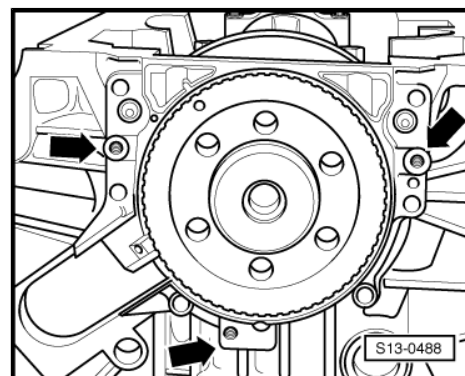
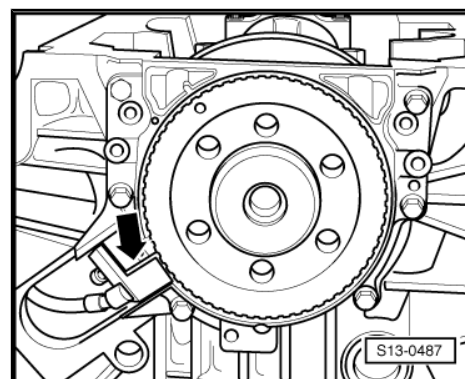
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- Screw 3 screws M6x35 into the threaded bores of the sealing flange -arrows-.
- Press out sealing flange together with rotor from the crankshaft by alternately screwing the screws into the sealing flange.



Note

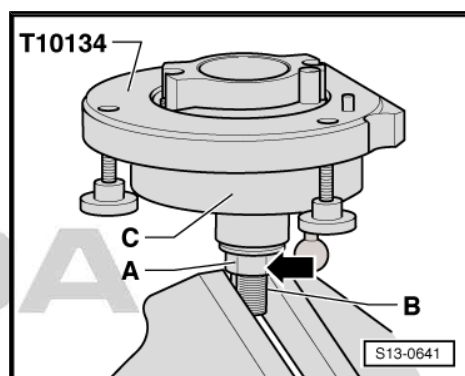
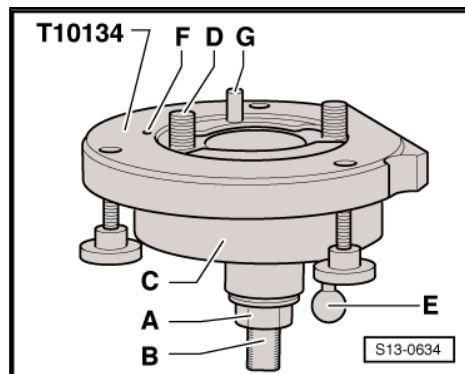
- ◆ *The sealing flange with PTFE gasket ring is provided with sealing lip supporting ring. This supporting ring is intended as an assembly sleeve and must not be removed before installing.*
- ◆ *Do not separate or turn the sealing flange and rotor after removing them from the spare part package.*
- ◆ *The rotor is given its fitting location by fixing the assembly tool - T10134- to the positioning pin.*
- ◆ *The sealing flange and gasket ring form one unit and must be replaced together with the rotor.*
- ◆ *The rotor has an elastomer layer on its sealing surface with the crankshaft. This layer must not be brought into contact with dirt or grease.*
- ◆ *The assembly tool - T10134- is given its fitting location to the crankshaft by means of a guide bolt, which is guided into the threaded bore of the crankshaft.*



2.3.2 A - Mounting the sealing flange with rotor on the assembly tool -T10134-

- A - Hexagon nut
- B - Clamping surface
- C - Assembly cup
- D - Allan screw
- E - Guide bolts (with red handle - for fuel engine)
- F - Positioning pin
- G - Guide bolts (with black handle - for diesel engine)

- Grip the assembly tool on the clamping surface -B- of the threaded spindle in a vice.

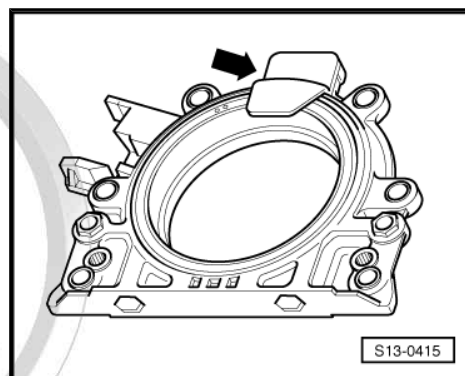


- Remove the securing clip -arrow- from the new sealing flange.



Note

Do not remove or turn the rotor from the sealing flange.

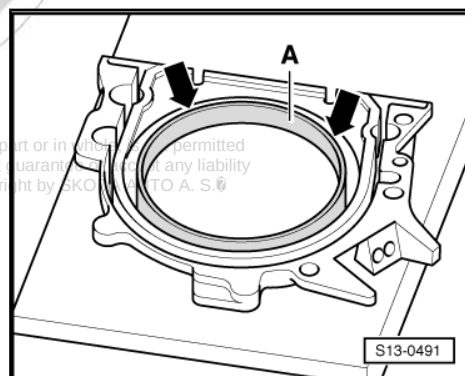


- Lay the front side of the sealing flange on a clean and level surface.
- Press the sealing lip supporting ring -A- -arrows-, until it rests on the level surface.

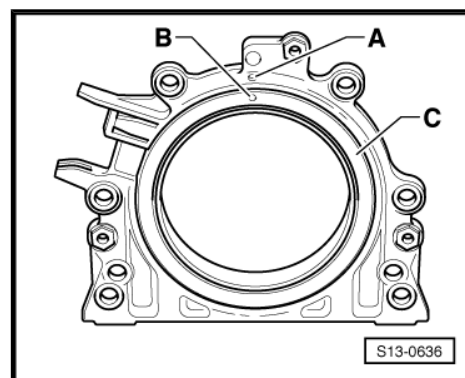


Note

The top side of the rotor and the front side of the sealing flange must be flush.



The locating hole -B- on the rotor -C- must be flush with the marking -A- on the sealing flange.

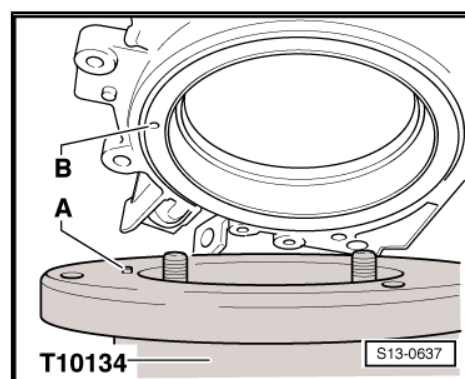


- Lay the sealing flange with the front side on the assembly tool in such a way that the positioning pin -A- engages into the hole -B- of the rotor.

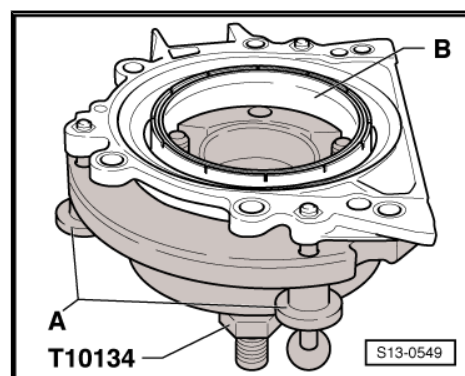


Note

Make sure the sealing flange lies flat on the assembly tool.



- When tightening the knurled screws -A- press the sealing lip supporting ring -B- on the surface of the assembly tool in such a way that the positioning pin cannot slide out of the rotor hole.

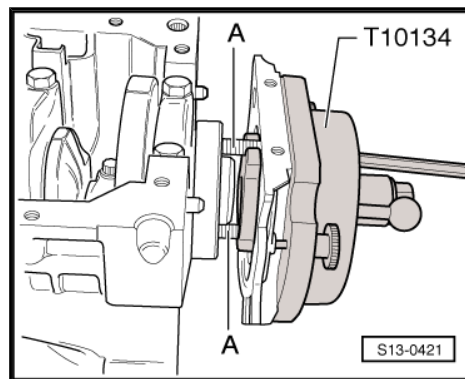


2.3.3 B - Mounting the assembly tool - T10134- with sealing flange on the crankshaft flange

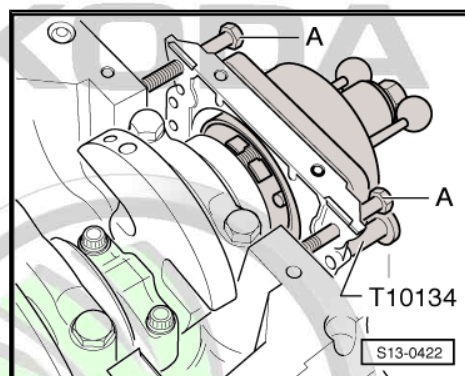
- The crankshaft flange must be free of grease and oil
- The engine is positioned on TDC for cylinder 1

- Unscrew hexagon nut -B- up to the end of the threaded spindle.

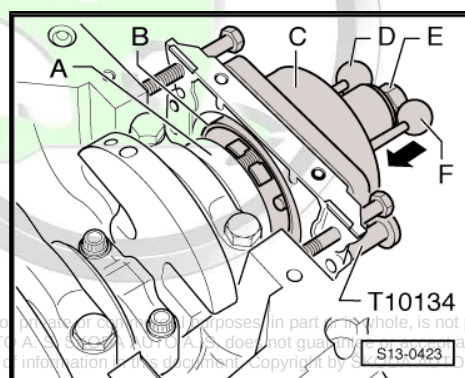
- Screw assembly tool with Allan screws -A- onto the crankshaft flange up to the stop.



- Screw in two M6x35 mm screws -A- by about 3 turns for sealing flange guide into the cylinder block.



- Move the assembly cup -C- by hand in the -direction of the arrow- until the rotor -B- rests on the crankshaft flange -A-. Subsequently insert the guide bolt with red ball -F- fully into the threaded bore of the crankshaft. If the guide bolt is correctly seated, the ball is approx. 10 mm from the assembly cup -C-. This gives the rotor its final fitting location.
- Screw in hexagon nut -E- by hand onto the threaded spindle until it rests against the assembly cup -C-.



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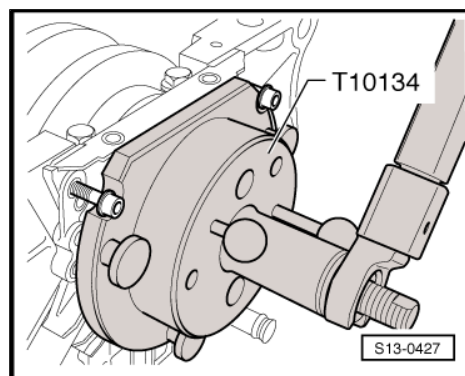
2.3.4 C - Pressing the rotor onto the crankshaft flange

- Tighten the hexagon nut of the assembly tool using a torque wrench with adapter. Tightening torque: 35 Nm.



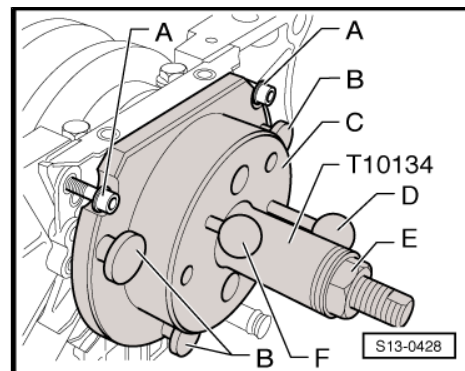
Note

After tightening the nut to 35 mm there must still be a narrow air gap between the cylinder block and the sealing flange.

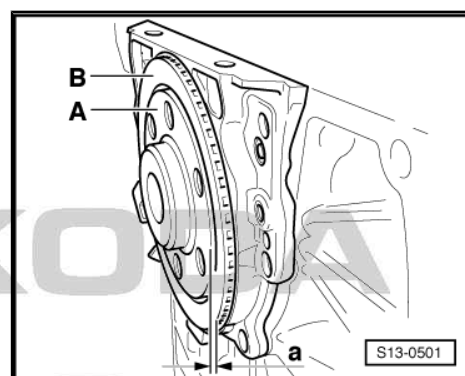


2.3.5 D - Inspecting the fitting position of the rotor on the crankshaft

- Unscrew hexagon nut -E- up to the end of the threaded spindle.
- Unscrew two M6x35 mm screws -A- from the cylinder block.
- Unscrew three knurled screws -B- from the sealing flange.
- Unscrew two Allan screws and remove assembly tool.
- Remove sealing lips supporting ring.



The fitting position of the rotor on the crankshaft is accurate if there is a distance -a- of 0.5 mm between the crankshaft flange -A- and the rotor -B-.



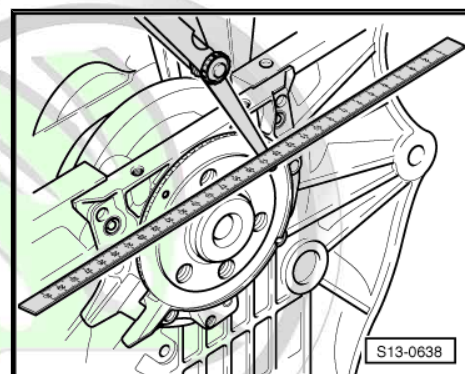
- Position the steel straightedge onto the crankshaft flange.
- Measure the distance between the steel straightedge and the rotor with a feeler gauge.

If the measured distance is less than 0.5 mm:

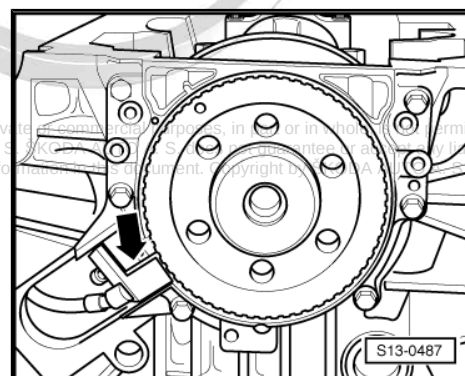
- Press down rotor ⇒ [page 34](#) .

If the dimension is correct:

- Tighten the new fixing screws of the sealing alternately cross-wise. Tightening torque: 12 Nm.

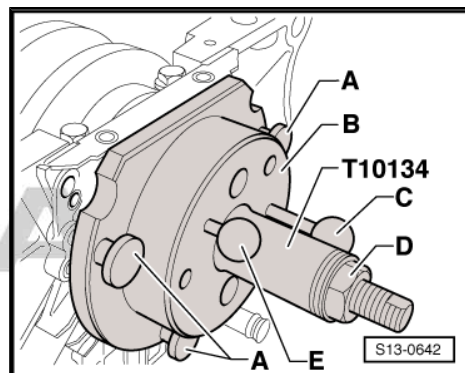


- Install engine speed sender -G28- -arrow-. Tightening torque: 5 Nm.
- Installing the oil pan ⇒ [page 63](#) .
- Installing intermediate plate.
- Install flywheel with new screws. Tighten the fixing screws to 60 Nm + 1/4 turn (90°).



2.3.6 E - Pressing down the rotor

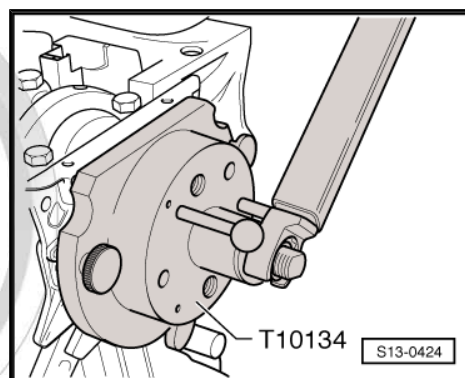
- Screw assembly tool - T 10134- with Allan screws up to the stop onto the crankshaft flange.
- Screw in 3 knurled screws -A- into the flange.
- Subsequently insert the guide bolt with red ball -E- fully into the threaded bore of the crankshaft. If the guide bolt is correctly seated, the ball is approx. 10 mm from the assembly cup -B-.
- Screw in hexagon nut -D- by hand onto the threaded spindle until it rests against the assembly cup -B-.



- Tighten the hexagon nut of the assembly tool using a torque wrench with adapter. Tightening torque: 40 Nm.
- Again inspect the fitting position of the rotor on the crankshaft
⇒ [page 33](#) .

If the dimension -a- is again too small:

- Tighten the hexagon nut of the assembly device to 45 Nm.
- Again inspect the fitting position of the rotor on the crankshaft
⇒ [page 33](#) .



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3 Assembly overview - piston and conrod

1 - Circlip

2 - Piston pin

- ☐ if stiff, heat piston to approx. 60°C
- ☐ Remove and install with bracket -T10014-

3 - Piston

- ☐ check ➔ [page 36](#)
- ☐ mark installation position and matching cylinder
- ☐ arrow on the piston crown faces towards the belt pulley side
- ☐ Ø Piston = 76.47 mm

4 - Piston rings

- ☐ Offset joint 120°
- ☐ use piston ring pliers for removing and installing
- ☐ remove and install 3-part oil scraper rings by hand
- ☐ marking -TOP- must face towards piston crown
- ☐ Inspect gap clearance ➔ [page 36](#)
- ☐ Inspect end clearance ➔ [page 36](#)

5 - Conrod

- ☐ always replace as a set only
- ☐ mark matching cylinder -A-
- ☐ Fitting position: Markings -B- point to belt pulley side
- ☐ located axially by pistons

6 - Conrod bearing cap

- ☐ as a result of the conrods separated in the cracking process, the cover fits only in one position and only to the relevant conrod

7 - Conrod bolt

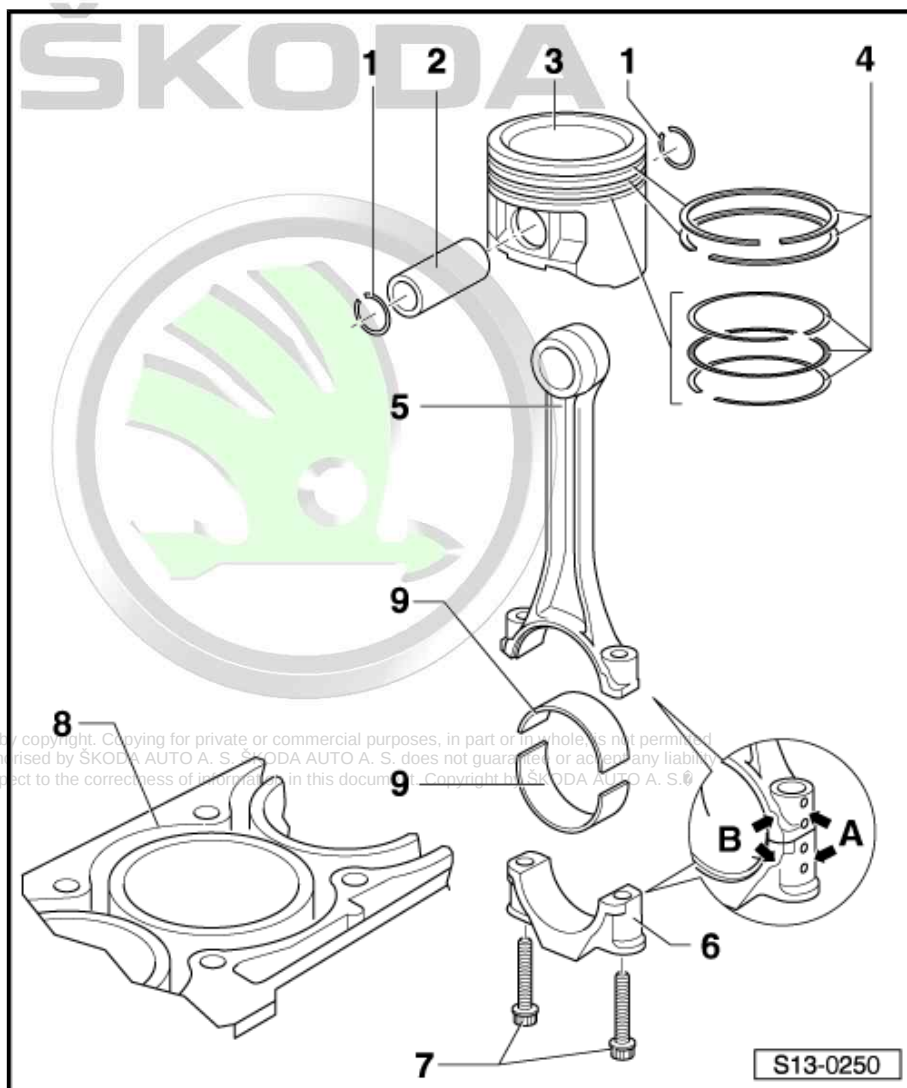
- ☐ M7×0.75: Turn a further 20 Nm + 1/4 turns (90°).
- ☐ M8×1: Turn a further 30 Nm + 1/4 turns (90°).
- ☐ replace
- ☐ Oil thread and contact surface

8 - Cylinder block

- ☐ inspect cylinder bore ➔ [page 37](#)
- ☐ Ø Cylinder = 76.51 mm

9 - Bearing shell

- ☐ do not mix up already used bearing shells (mark)





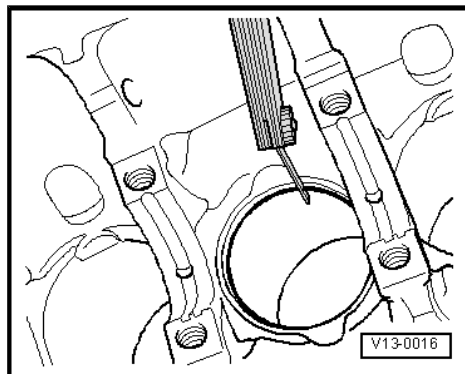
- ☐ insert bearing shells in the centre

Inspecting piston ring gap clearance

- Push in ring at right angles to the cylinder wall from the top through to the bottom cylinder opening, about 15 mm from the cylinder edge.

Piston ring dimensions in mm	new	Wear limit
1. Compression ring	0.20...0.50	1.0
2. Compression ring	0.40...0.70	1.0
Oil scraper ring	0.40...1.40	— ¹⁾

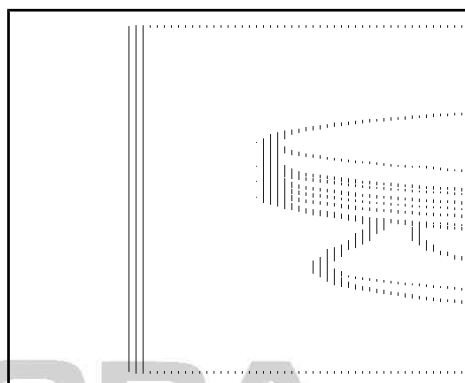
1) no specification possible for wear limit



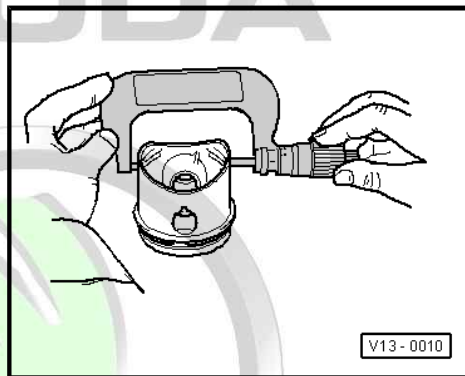
Inspect piston ring end clearance

- Clean annular groove before measurement is taken.

Piston ring dimensions in mm	new	Wear limit
1. Compression ring	0.04...0.08	0.15
2. Compression ring	0.04...0.08	0.15
Oil scraper ring	cannot be measured	



Inspecting pistons



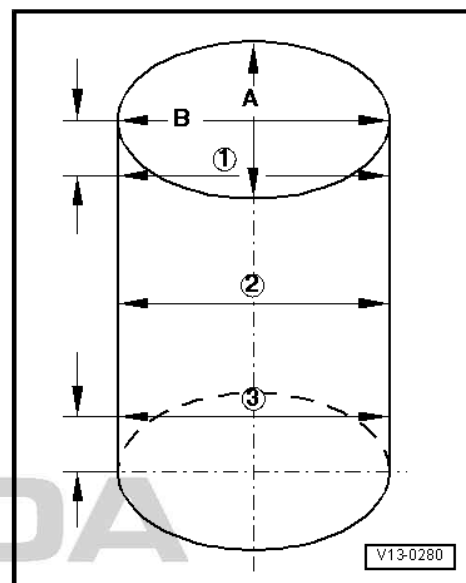
Special tools and workshop equipment required

- ◆ External micrometer 75...100 mm
- Measure about 10 mm from the lower edge, offset at right angles to the piston pin shaft.

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- ◆ Variation compared to nominal diameter max. 0.04 mm

Inspecting cylinder bore



Special tools and workshop equipment required

- ◆ Internal precision measuring instrument 50...100 mm
- Measure at three points crosswise in a transverse direction -A- and lengthwise -B-.
- ◆ Variations compared to nominal dimension max. 0.08 mm



Note

Do not measure the cylinder bore if the cylinder block is fixed to the assembly stand with the engine mount -MP 1-202- , as this may result in incorrect measurements.

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15 – Cylinder head, valve gear

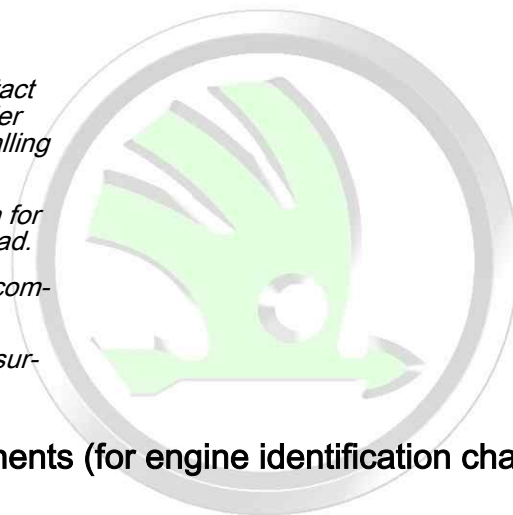
1 Cylinder head

Testing compression pressure ⇒ [page 48](#) .



Note

- ◆ *When installing a replacement cylinder head, all the contact surfaces between the hydraulic supporting elements, roller rocker arms and the cam tracks must be oiled before installing the camshaft housing.*
- ◆ *Do not remove the plastic bases supplied as a protection for the open valves until just before fitting on the cylinder head.*
- ◆ *If the cylinder head is replaced, the system must also be completely filled with fresh coolant.*
- ◆ *Before assembly moisten all bearing points and contact surfaces with oil.*



1.1 Cylinder head - Summary of components (for engine identification characters BCA)

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1 - Top toothed belt guard

2 - Main drive toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ Routing of toothed belt ➔ [page 16](#)
- ☐ removing and installing, tensioning ➔ [page 19](#)

3 - Coupling drive - toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ removing and installing, tensioning ➔ [page 19](#)

4 - 10 Nm

5 - Guide

- ☐ tighten at camshaft housing to 8 Nm

6 - Threaded bolt, 6 Nm

- ☐ for air filter housing

7 - Coolant pipe

8 - Hall sender -G40-

9 - O-ring

- ☐ replace

10 - Support

11 - Roller rocker arm

- ☐ Check smooth operation of cylindrical-roller bearings
- ☐ oil contact surfaces
- ☐ When installing, secure to supporting element using securing clip.

12 - Shackle

13 - 20 Nm

14 - Dowel pins

15 - Hydraulic supporting element

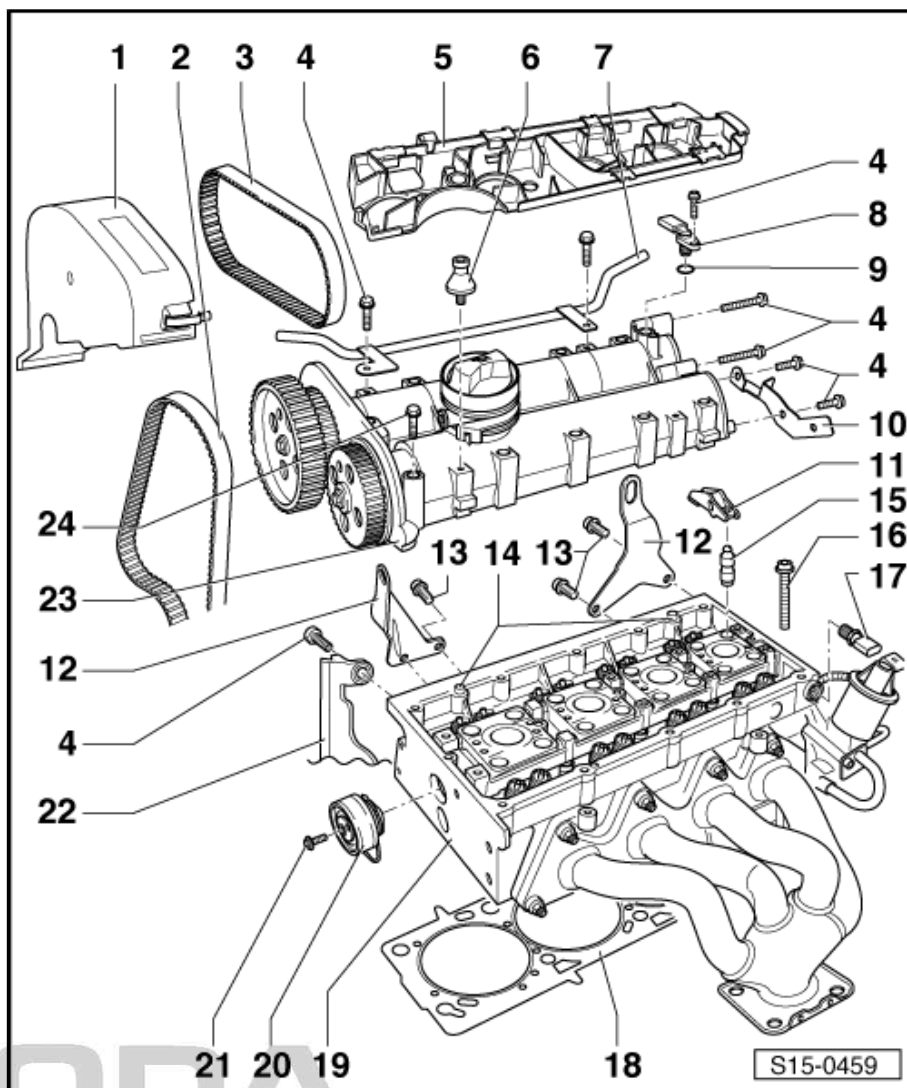
- ☐ do not interchange
- ☐ with hydraulic valve clearance compensation
- ☐ oil contact surface
- ☐ before installing check axial play of the camshaft ➔ [page 50](#)

16 - Cylinder head bolt

- ☐ replace
- ☐ observe the mounting instructions and sequence for loosening and tightening ➔ [page 45](#)

17 - Oil pressure switch - F1- , 25 Nm

- ☐ Switching pressure 0.03 ... 0.07 MPa (0.3 ... 0.7 bar)
- ☐ check ➔ [page 67](#)
- ☐ Cut open gasket ring if leaking and replace





18 - Cylinder head gasket

- ☐ replace
- ☐ metal gasket

19 - Cylinder head

- ☐ removing and installing ⇒ [page 45](#)
- ☐ check for distortion ⇒ [page 42](#)
- ☐ Sealing surfaces to the camshaft housing must be free of oil and grease.
- ☐ after replacing fill entire system with fresh coolant

20 - Coupling drive tensioning pulley

- ☐ check ⇒ [page 25](#)
- ☐ Tensioning toothed belt ⇒ [page 21](#)

21 - 20 Nm

22 - Rear toothed belt guard

23 - Camshaft housing

- ☐ removing and installing ⇒ [page 42](#)
- ☐ when installing, fit onto pin screws and dowel pins vertically from above

24 - Turn a further 10 Nm + 1/4 turns (90°).

- ☐ replace
- ☐ tighten from inside to outside

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1.2 Cylinder head - Summary of components (for engine identification characters BUD, CGGA)

1 - Top toothed belt guard

2 - Main drive toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ Routing of toothed belt ⇒ [page 16](#)
- ☐ removing and installing, tensioning ⇒ [page 19](#)

3 - Coupling drive - toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ removing and installing, tensioning ⇒ [page 19](#)

4 - 10 Nm

5 - Heat shield

6 - Guide

- ☐ tighten at camshaft housing to 8 Nm

7 - Hall sender -G40-

8 - O-ring

- ☐ replace

9 - Roller rocker arm

- ☐ inspect roller bearings for smooth operation
- ☐ oil contact surfaces
- ☐ When installing, secure to supporting element using securing clip.

10 - Shackle

11 - 20 Nm

12 - Dowel pins

13 - Hydraulic supporting element

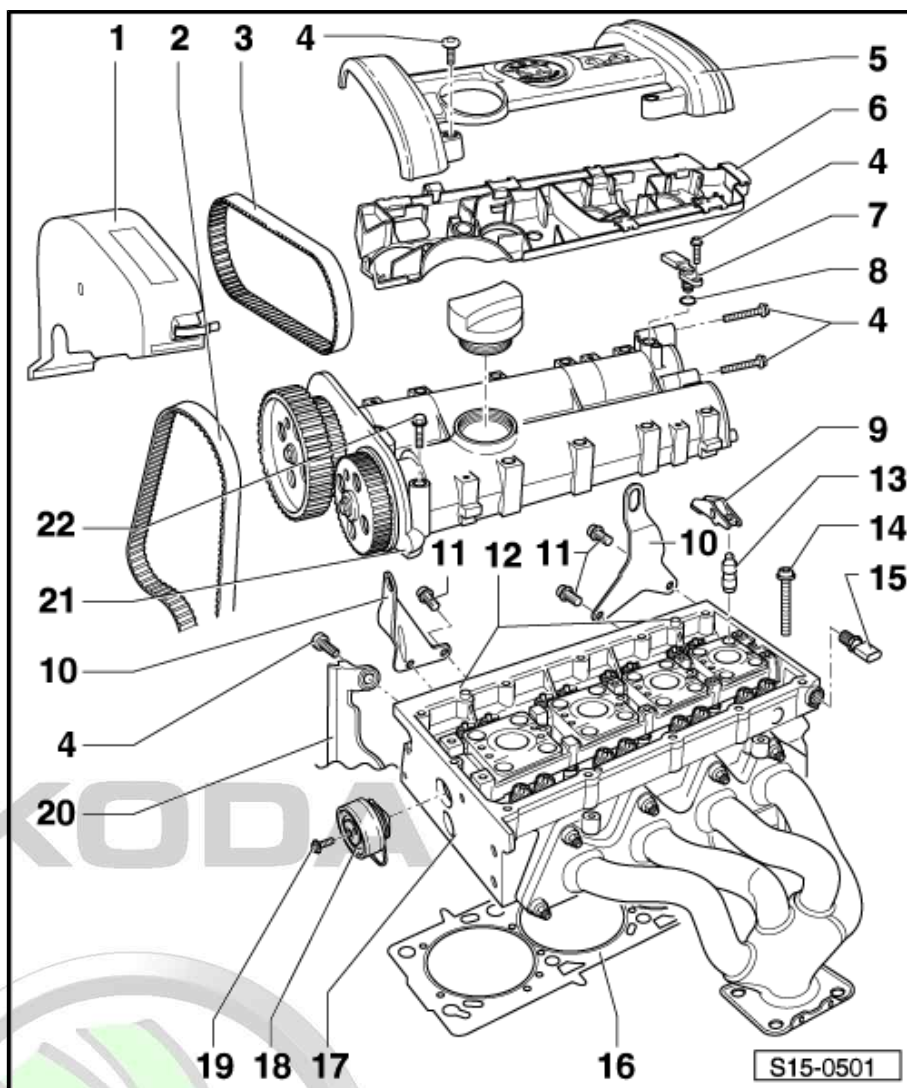
- ☐ do not interchange
- ☐ with hydraulic valve clearance compensation
- ☐ oil the contact surfaces before installing
- ☐ before installing check axial play of the camshaft ⇒ [page 50](#)

14 - Cylinder head bolt

- ☐ replace
- ☐ observe the mounting instructions and sequence for loosening and tightening ⇒ [page 45](#)

15 - Oil pressure switch - F1- , 25 Nm

- ☐ Switching pressure 0.03 ... 0.07 MPa (0.3 ... 0.7 bar)
- ☐ check ⇒ [page 67](#)





- ☐ Cut open gasket ring if leaking and replace

16 - Cylinder head gasket

- ☐ replace
- ☐ metal gasket

17 - Cylinder head

- ☐ removing and installing ➔ [page 45](#)
- ☐ check for distortion ➔ [page 42](#)
- ☐ Sealing surfaces to the camshaft housing must be free of oil and grease.
- ☐ after replacing fill entire system with fresh coolant

18 - Coupling drive tensioning pulley

- ☐ check ➔ [page 25](#)
- ☐ Tensioning toothed belt ➔ [page 21](#)

19 - 20 Nm

20 - Rear toothed belt guard

21 - Camshaft housing

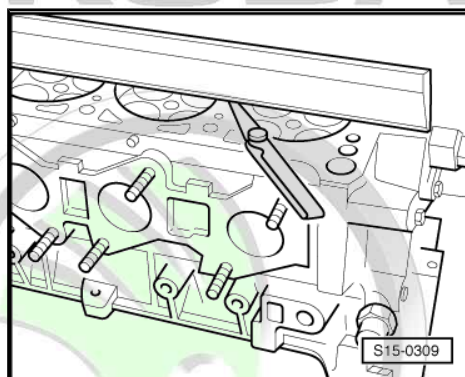
- ☐ removing and installing ➔ [page 42](#)
- ☐ when installing, fit onto pin screws and dowel pins vertically from above

22 - Turn a further 10 Nm + 1/4 turns (90°).

- ☐ replace
- ☐ tighten from inside to outside

Inspecting the cylinder head for distortion

Maximum permitted distortion: 0.05 mm



1.3 Removing and installing camshaft housing

Special tools and workshop equipment required

- ◆ Counterholder - T30004 (3415)- with bolts - T30004/1 (3415/1)-
- ◆ Extractor -T10094A-
- ◆ Camshaft clamp - T10016-
- ◆ Sealant remover gasket stripper (bearing code GST, bearing article no. R 34402), manufacturer Retech s.r.o.
- ◆ Cleaning and degreasing agent, e.g. - D 009 401 04-
- ◆ Sealant -D 188 003 A1-

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1.3.1 Removing

Note

- ◆ *The camshafts are located in the camshaft housing. This is why the camshaft housing must only be removed once the two toothed belts have been removed.*
- ◆ *Do not rework the sealing surface of the camshaft housing.*
- ◆ *Removing and installing camshafts ⇒ [page 50](#) .*

For engine with identification characters BCA

- Remove engine cover with air filter ⇒ [page 114](#) .

For engines with identification characters BUD, CGGA

- Remove the air filter housing ⇒ [page 115](#) .

Continued for all vehicles

- Removing both timing belts ⇒ [page 19](#) .

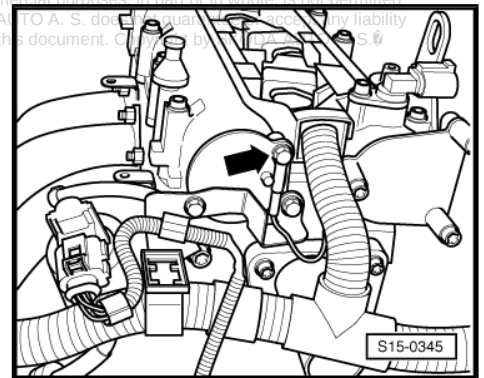
- Unscrew earth lead from camshaft housing -arrow-

For engine with identification characters BCA

- Removing oil filler inlet ⇒ [page 63](#) .

Continued for all vehicles

- Removing ignition coils ⇒ [page 132](#) .
- Remove guide with wiring loom from camshaft housing.
- Remove the coolant ventilation line from the camshaft housing.
- Disconnect the 3-pin plug from the hall sender.
- Release the fixing screw for the rear toothed belt guard near the right lifting eye.
- Slacken the screws for the cylinder head housing crosswise from outside to inside and unscrew.
- Carefully remove the camshaft housing.
- Remove the roller rocker arm together with the hydraulic supporting elements and lay aside on a clean surface. Make sure that the roller rocker arms and the hydraulic supporting elements are not interchanged.



1.3.2 Install

- The crankshaft - toothed belt sprocket is secured to the crankshaft with a screw and two washers.
- The pistons must not be in TDC.
- Lock the camshaft sprockets with camshaft lock - T10016- in the fit holes in the camshaft housing and secure them against turning ⇒ [page 52](#) .

Note

When turning the camshaft the valves may touch the piston in TDC.



WARNING

Wear protective gloves and goggles when working with gasket remover and degreasing agent!

- Remove residual sealant on the cylinder head and on the camshaft housing using a chemical sealant remover.
- Ensure that no dirt and sealant residues get into the cylinder head.
- Degrease the sealing surfaces.
- Apply a thin coating of sealant -D 188 003 A1- uniformly on the clean sealing surface of the camshaft housing (see grid surface in the illustration).

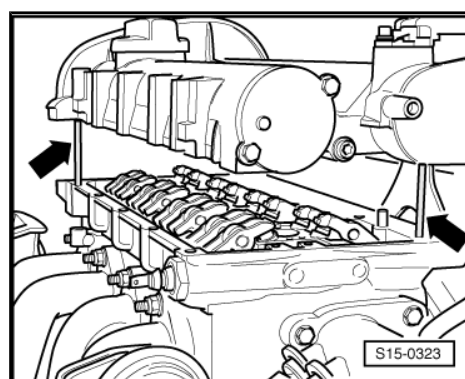
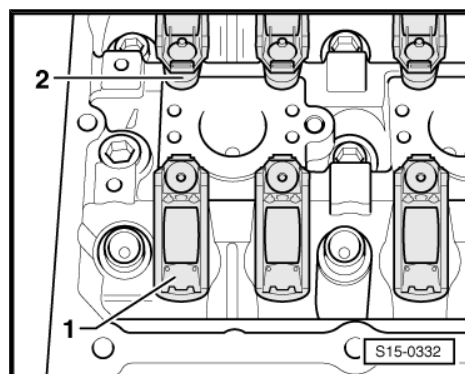
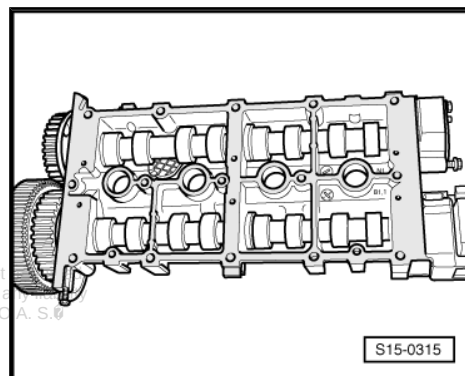


Note

The sealant must not be applied too thickly, as otherwise excess sealant may penetrate into the oil bores and possibly cause engine damage.

- Make sure all roller rocker arms are correctly positioned on the end of valve stems -1- and on the relevant hydraulic supporting elements -2-.
- Screw in two pin screws (M6 x 70 mm) into the cylinder head before fitting the camshaft housing.

- Carefully place the camshaft housing at right angles to the cylinder wall onto the pin screws -arrows- and dowel pins of the cylinder head.



- Tighten the new fixing screws of the camshaft housing diagonally and evenly from the inside to the outside. Tightening torque 10 Nm + torque a further $\frac{1}{4}$ turn (90°).



WARNING

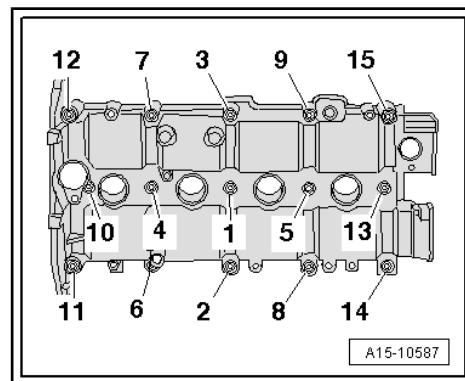
The camshaft housing must not tilt!



Note

- ◆ After installing the camshaft housing, allow the sealant to dry for about 30 minutes.
- ◆ After installing new hydraulic supporting elements, the engine must not be started for about 30 minutes. The hydraulic supporting elements must "settle" (otherwise valves would strike the pistons).

Further installation occurs in reverse order to removal.



1.4 Removing and installing the cylinder head

Special tools and workshop equipment required

- ◆ Supporting device - T30099-
- ◆ Base - T30099/1-
- ◆ Counterholder - T30004 (3415)- with bolts - T30004/1 (3415/1)-
- ◆ Support - T10014-
- ◆ Extractor - T10094A-
- ◆ Pliers for spring strap clamps
- ◆ Catch pan, e.g. -V.A.G 1306-
- ◆ Sealant remover gasket stripper (bearing code GST, bearing article no. R 34402), manufacturer Retech s.r.o.
- ◆ Sealant -D 188 003 A1-

Requirements

- Engine temperature should not exceed 35 °C, because the cylinder head could be twisted when slackening the screws.
- The pistons must not be in TDC.

1.4.1 Removing

- Removing the camshaft housing ➔ [page 42](#) .



WARNING

Hot steam may escape when the compensation bottle is opened. Cover the cap with a cloth and open carefully.

- Open and close the cap of the expansion reservoir to reduce the pressure in the cooling system.
- Drain coolant ➔ [page 74](#) .



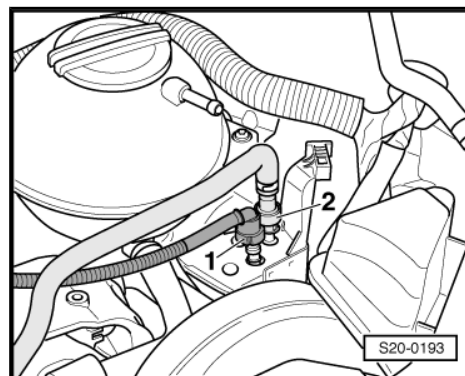
- Release spring strap clamps and disconnect coolant hoses of the coolant regulator housing.
- Remove the guide tube for the oil dipstick.



WARNING

The fuel system is under pressure! Place a clean cleaning cloth around the connection point before detaching hose connections. Reduce pressure by carefully removing the hose.

- Remove fuel feed line -2-. To do so press the release buttons.
- Seal the lines so that no dirt can get into the fuel system.
- Observe rules for cleanliness ➔ [page 2](#) .
- Release or disconnect the following components:
 - ◆ Hose to activated charcoal container system of intake manifold.
 - ◆ Vacuum hose to brake servo unit from intake manifold.
 - ◆ Plug connection of knock sensor (rear cylinder block) and intake manifold pressure sender with intake manifold temperature sender.
 - ◆ Plug connection of engine speed sender.
 - ◆ Plug connection of coolant temperature sender, oil pressure switch and exhaust gas recirculation valve.
 - ◆ Plug connection of the throttle valve control unit.
 - ◆ Plug connections of the injection valves.
 - ◆ Plug connection of heated vacuum valve at oil separator.
 - ◆ Crankcase ventilation hose at intake manifold.
- Remove/unclamp all other necessary electrical cables from the engine and expose them.
- Unscrew the pre-exhaust pipe from the exhaust manifold and hook up ➔ [page 125](#) .

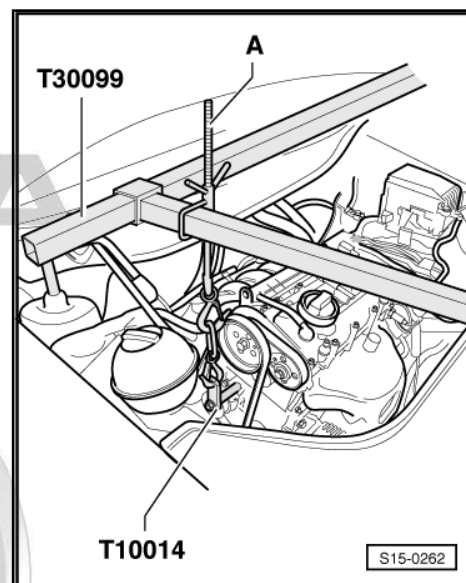


Note

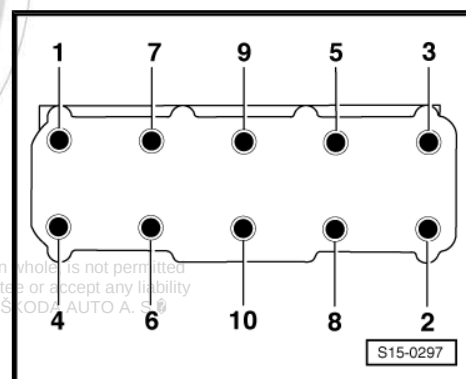
Both lifting eyes are located on the cylinder head, this is why an additional holder must be fitted on the cylinder block to support the engine.

- Removing bracket for guide pulley ➔ [page 16](#) .
- Screw in bracket - T10014- in the location of the removed guide pulley. Tightening torque: 20 Nm
- Support engine from underneath.

- Support engine with the spindle -A-.
- Remove the clips on the coolant regulator housing, which secure the coolant pipe to the coolant pump.



- Slacken cylinder head bolts in the order shown and unscrew.
- Carefully remove the cylinder head.



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1.4.2 Install



Note

- ◆ *There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.*
- ◆ *Remove the new cylinder head gasket from its wrapping immediately before fitting.*
- ◆ *Treat the new gasket with the utmost care. Any damage will result in leaks.*
- ◆ *Replace cylinder head bolts.*
- Make sure that when cleaning the cylinder head and cylinder block no impurities can get into the cylinder or into the oil and coolant galleries.



WARNING

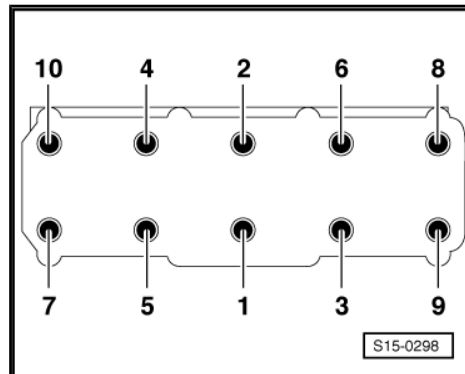
Wear protective goggles and gloves when working with sealant and grease remover!

- When conducting repairs sealant residues should be removed from the contact surface of the cylinder head/cylinder block using a chemical gasket remover.
- Position piston of the cylinder 1 on TDC ➤ [page 19](#) .



- Position the new cylinder heads. The legend (part number) must be legible.
- Insert the cylinder head. Pay attention to the centering pins in the cylinder block.
- Insert new cylinder head bolts and tighten by hand.
- Tighten the cylinder head bolts in the order shown:
- First of all tighten all bolts to 30 Nm.
- Torque all bolts $\frac{1}{4}$ turn (90°) further with a rigid wrench.
- Next, torque all bolts again $\frac{1}{4}$ turn (90°) further with a rigid wrench.
- Insert the hydraulic supporting elements in the cylinder head and position the relevant roller rocker arms on the valve stem ends.

Further installation occurs in reverse order.



1.5 Testing the compression

Special tools and workshop equipment required

- ◆ Spark plug wrench, e.g. - 3122 B-
- ◆ Compression tester, e. g. - V.A.G 1763-
- ◆ Extractor - T10094A-
- ◆ Camshaft clamp - T10016-

Test requirements:

- Engine oil temperature at least 30°C .

Work procedure

For engine with identification characters BCA

- Remove engine cover with air filter ➔ [page 114](#) .
- Removing oil filler inlet ➔ [page 63](#) .

For engine with identification characters BUD, CGGA

- Remove protective cover ➔ [page 50](#) .

Continued for all vehicles

- Removing ignition coils ➔ [page 132](#) .
- Unscrew the spark plugs with spark plug wrench.
- Remove the fuse for the voltage supply of the injection valves and the ignition coils from the fuse holder ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

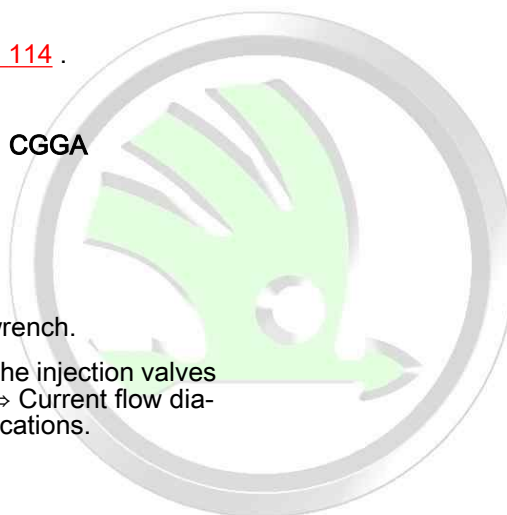


Note

Removing the fuses interrupts the voltage supply of the injection valves and the ignitions coils.

- Check compression pressure using the compression tester.

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i Note

The use of the tester is described in the relevant operating instructions.

- Operate starter until the tester no longer indicates a pressure rise.

Compression readings:

New engine	Wear limit	Difference between cylinders
1...1.5 MPa (10...15 bar)	0.7 MPa (7 bar)	0.3 MPa (3 bar)

If the specified values are not reached, test the combustion chamber for tightness ➔ [page 49](#) .

- Screw in the spark plug with spark plug wrench and then tighten fully to 30 Nm.

Further installation occurs in reverse order.

- Query fault memories, rectify any faults and erase fault memories ➔ Vehicle diagnostic tester.

1.6 Testinf the combustion chamber for tightness

Special tools and workshop equipment required

- ◆ Pressure hose - MP1-210 (VW 653/3)- (replace gasket ring with a spark plug gasket ring)
- ◆ Spark plug wrench

Test sequence

- Unscrew the spark plugs.
- Position piston of the relevant cylinder to top dead centre (TDC).
- Screw the pressure hose MP 1-210 into the spark plug thread.
- Connect pressure hose to compressed air.
- With the assistance of a second mechanic, lock the screw at the crankshaft on TDC position in order to avoid the displacement of the piston after pressure build-up.
- Build up a pressure of approx. 0.3 MPa (3 bar) in the combustion chamber.
- Determine how the pressure escapes:
 - 1 - Via the inlet valve(s) - the pressure enters the throttle valve.
 - 2 - Via the outlet valve(s) - the pressure enters the exhaust system.
 - 3 - Via the piston rings - the pressure enters the cylinder block.

2 Valve gear

2.1 Assembly overview - valve gear

1 - 10 Nm

- ☐ only on engines with identification characters BUD, CGGA

2 - Heat shield

- ☐ only on engines with identification characters BUD, CGGA

3 - Guide

- ☐ tighten at camshaft housing to 8 Nm

4 - Turn a further 20 Nm + 1/4 turns (90°).

- ☐ replace
- ☐ to release and tighten use camshaft lock - T10016- ➔ [page 52](#)

5 - Camshaft sprocket

- ☐ Pay attention to position of toothed belt when installing ➔ [page 19](#)

6 - Sealing ring

- ☐ only replace with the camshaft installed
- ☐ Lightly oil sealing lip
- ☐ replace ➔ [page 56](#)

7 - Coupling drive - toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ removing and installing, tensioning ➔ [page 19](#)

8 - Turn a further 10 Nm + 1/4 turns (90°).

- ☐ replace
- ☐ tighten from inside to outside

9 - Camshaft housing

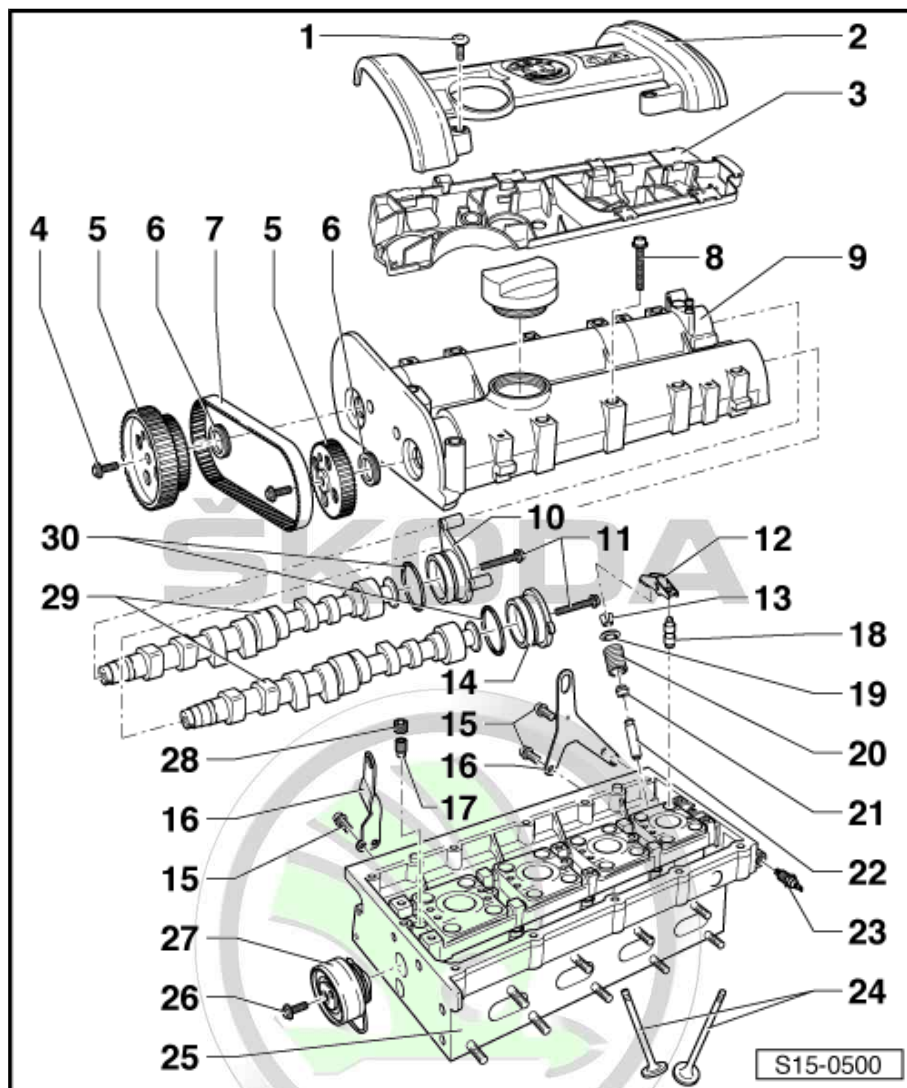
- ☐ removing and installing ➔ [page 38](#)
- ☐ when installing, fit onto pin screws and dowel pins vertically from above

10 - Cover

11 - 10 Nm

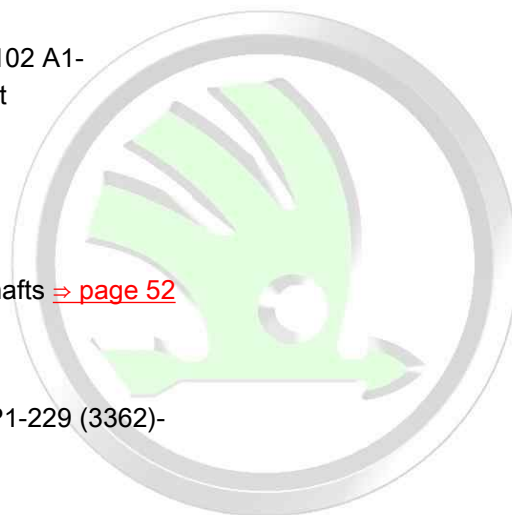
12 - Roller rocker arm

- ☐ Check smooth operation of cylindrical-roller bearings
- ☐ oil contact surface
- ☐ for installing, fasten locking clip to hydraulic supporting element



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13 - Collets

14 - Cover

15 - 20 Nm

16 - Shackle

17 - Non-return valve, 6 Nm

- ☐ Clean thread and install with sealant - D 154 102 A1-
- ☐ do not tighten excessively as the valve may tilt

18 - Hydraulic supporting element

- ☐ do not interchange
- ☐ with hydraulic valve clearance compensation
- ☐ oil contact surface
- ☐ before installing check axial play of the camshafts ⇒ [page 52](#)

19 - Valve spring retainer

20 - Valve spring

- ☐ removing and installing with blank holder - MP1-229 (3362)-

21 - Valve stem seal

- ☐ replace ⇒ [page 57](#)

22 - Valve guide

- ☐ check ⇒ [page 57](#)

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23 - Oil pressure switch - F1- , 25 Nm

- ☐ Switching pressure 0.03 ... 0.07 MPa (0.3 ... 0.7 bar)
- ☐ check ⇒ [page 67](#)
- ☐ Cut open gasket ring if leaking and replace

24 - Valves

- ☐ do not rework, only grinding in is permissible
- ☐ Valve dimensions ⇒ [page 52](#)

25 - Cylinder head

- ☐ reworking valve seats ⇒ [page 53](#)
- ☐ reworking sealing surface ⇒ [page 53](#)

26 - 20 Nm

27 - Coupling drive tensioning pulley

- ☐ check ⇒ [page 25](#)
- ☐ Tensioning toothed belt ⇒ [page 25](#)

28 - Screw plug, 45 Nm

- ☐ install with sealant - D 154 102 A1-
- ☐ must not be screwed in too deep
- ☐ maximum permissible countersink of the camshaft housing contact surface 2 mm

29 - Camshafts

- ☐ Inspecting axial play ⇒ [page 52](#)
- ☐ Moisten with oil before installing
- ☐ after installation replace gasket rings ⇒ [page 56](#)

30 - O-ring

- ☐ replace
- ☐ moisten with oil before inserting



Locking both camshaft sprockets with the camshaft lock -T10016-

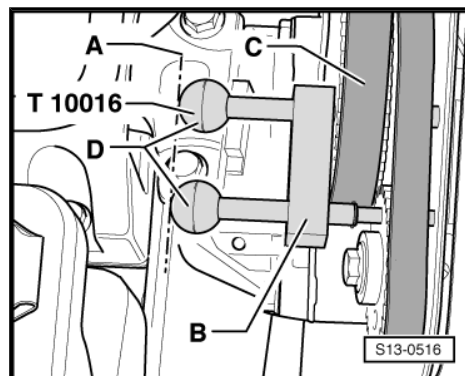
- Insert the two fixing pins through the locating holes of the camshaft sprockets up to the stop in the fit holes in the camshaft housing.



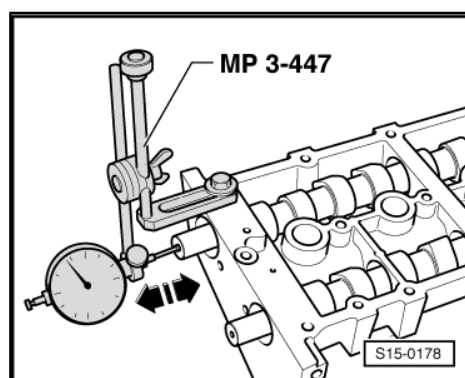
Note

The two fixing pins are correctly inserted if the end parts -D- are flush with line -A-.

- Slide the support -B- up to the stop on the inlet camshaft timing gear -C-.
- If both camshaft sprockets are locked in the fit holes, it is possible to slacken or screw them down.



Checking the axial play of the camshaft



Special tools and workshop equipment required

- ♦ Universal dial gauge holder - MP3-447 (VW 387)-
- ♦ Dial gauge

Carry out measurement with the camshaft housing removed and the end covers installed ➔ [Item 10 \(page 50\)](#) and ➔ [Item 14 \(page 51\)](#) .

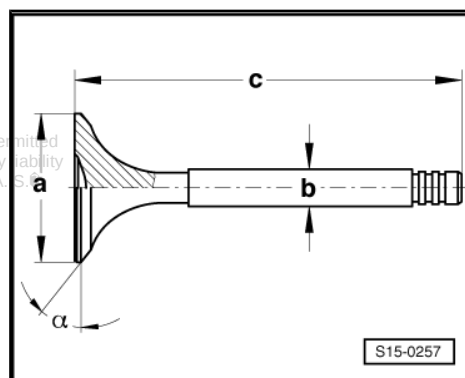
Wear limit: max. 0.40 mm.

Valve dimensions



Note

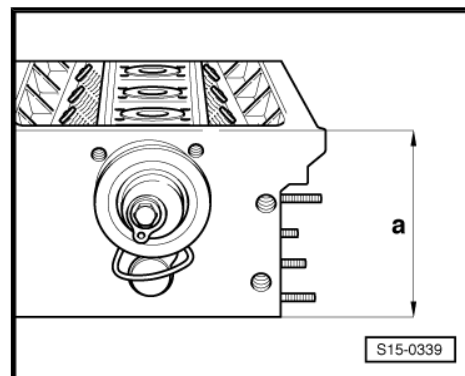
Valves must not be reworked. Only grinding in with grinding paste in the valve seat is permissible.



Dimension		Inlet valve	Exhaust valve
Ø a	mm	29.5	26.0
Ø b	mm	5.973	5.953
c	mm	100.9	100.5
α	°	45	45

Rework the lower cylinder head sealing surface

Permissible reworking dimension cylinder head: a = at least 108.25 mm.



2.2 Reworking valve seats

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ NAC milling cutter for reworking valve seats



Note

- ◆ When carrying out repairs on engines with leaking valves, it is not sufficient to machine or replace the valve seats and valves. It is also necessary to inspect the valve guides for wear, particularly on engines with a high mileage ⇒ [page 57](#).
- ◆ Rework valve seats only sufficiently in order to obtain a proper contact pattern. Calculate the maximum permissible reworking dimension before commencing. If the reworking dimension is exceeded, the proper operation of the hydraulic valve clearance compensation is no longer ensured. If this is the case replace the cylinder head.

Calculating maximum permissible reworking dimension

- Insert valve into the guide and press firmly against the valve seat.



Note

If the valve is replaced when carrying out repair work, use a new valve for the measurement.



- Measure distance between the valve stem end and the upper face of the cylinder head.
- Calculate max. permissible reworking dimension from the distance measured and the minimum dimension.

Minimum dimension: Inlet valve	7.6 mm
Minimum dimension: Exhaust valve	7.6 mm

“Measured distance” - “minimum dimension” = “max. permissible reworking dimension”.

Example:

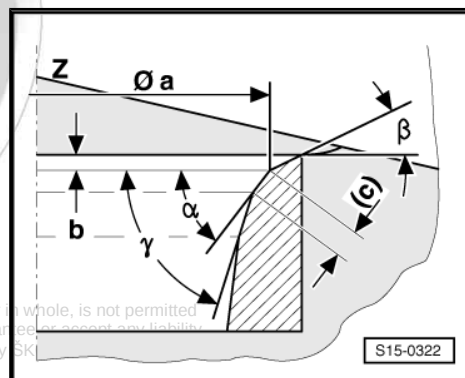
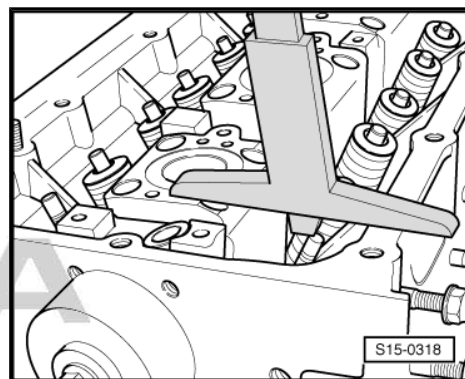
Measured distance	8.0 mm
- Minimum dimension	7.6 mm
= max. permissible reworking dimension ²⁾	0.4 mm

2) The max. permissible reworking dimension is shown in the figure for reworking the valve seats as dimension “b”.

reworking valve seats

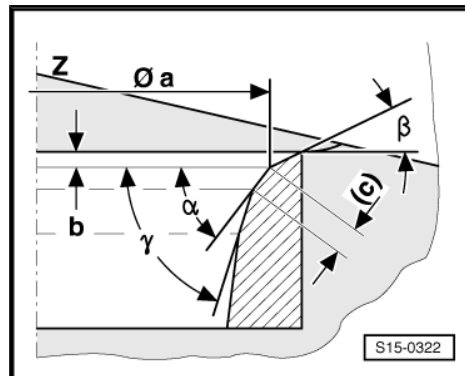
Reworking inlet valve seat

- a = $\varnothing$ 28.7 mm
- b = max. permissible reworking dimension
- c = 1.5...1.8 mm
- Z = Bottom edge of cylinder head
- α = 45 ° valve seat angle
- β = 30 ° top correction angle
- γ = 60 ° bottom correction angle



Reworking exhaust valve seat

- a = $\varnothing$ 25.0 mm
- b = max. permissible reworking dimension
- c = approx. 1.8 mm
- Z = Bottom edge of cylinder head
- α = 45 ° valve seat angle
- β = 30 ° top correction angle
- γ = 60 ° bottom correction angle



Work procedure

Reworking can be carried out by hand while complying with the following conditions:

- Wear limit of valve guides must not exceed the permissible dimension ➔ [page 57](#) .
- Use NAC milling cutter with carbide metal tips (min. 90 HRC).
- Press on the milling cutter using slight pressure and mill in such a way that an even removal of swarfs is ensured over the whole working surface.

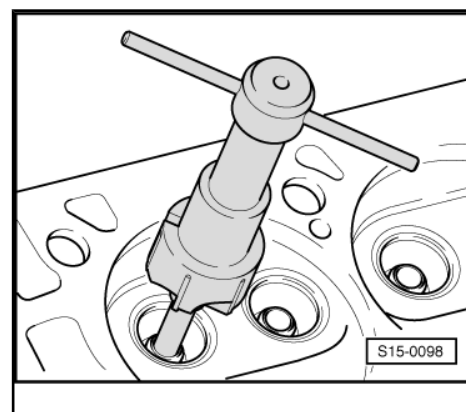
Reworking valve seats with NAC milling cutter

- Place cylinder head on a felt base and secure to prevent it from turning.
- Match diameter of guide drift to diameter of valve guide.

Valve guide	Ø Guide drift in mm
Inlet valve	6.0 - 0.01
Exhaust valve	

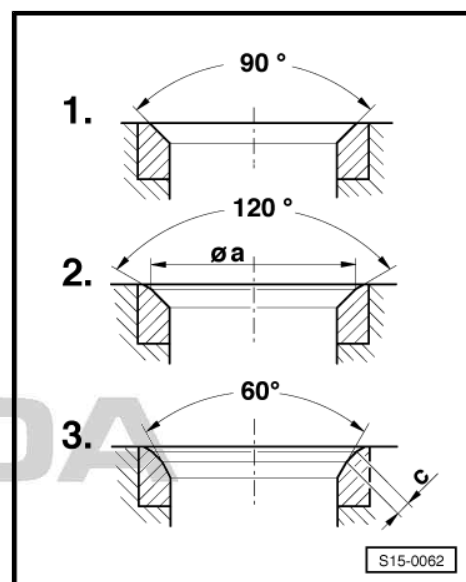
- Match diameter of milling cutter to diameter of valve seat.

Valve seat	Ø Milling cutter 90° mm	Ø Milling cutter 120° mm	Ø Milling cutter 60° mm
Inlet valve	32	32	21/34
Exhaust valve	30	30	21/34



Milling sequence

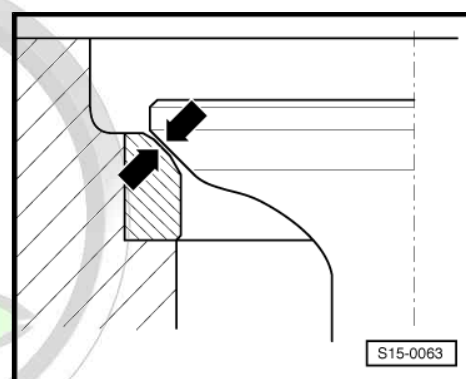
- 1 - Mill valve seat with 90° milling cutter until a perfect contact pattern is achieved. (Do not exceed maximum permissible reworking dimension!)
- 2 - Chamfer top correction angle with 120° milling cutter until the valve seat diameter -a- (⇒ [page 54](#)) is achieved.
- 3 - Mill bottom correction angle with 60° milling cutter until valve seat width -c- (⇒ [page 54](#)) is achieved.



- Grind in valve/valve seat with fine grinding paste so as to achieve a perfect contact pattern -arrows-.
- Check contact pattern e.g. with water colour (perfect contact pattern over entire circumference).
- Install valve springs.
- Inspect valves for tightness.

The tightness of the valves can be checked by filling petrol into the inlet and outlet canal (no petrol must flow out at the valve seat).

After completing the repair measure once again the distances between the valve stem ends and the upper face of the cylinder head and calculate the maximum permissible reworking dimension ⇒ [page 53](#) .



Note

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If the reworking dimension is exceeded, proper operation of the valve gear is no longer assured and the cylinder head must be replaced.



2.3 Replacing camshaft gasket rings

Special tools and workshop equipment required

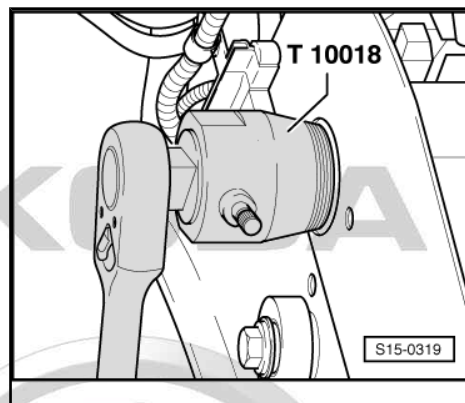
- ◆ Supporting device - T30099-
- ◆ Base - T30099/1-
- ◆ Counterholder - T30004 (3415)- with bolts - T30004/1 (3415/1)-
- ◆ Inserting device - T10015-
- ◆ Camshaft clamp - T10016-
- ◆ Gasket ring extractor - T10018-

Removing

- First remove the two toothed belts ➤ [page 19](#) .
- Turn crankshaft slightly back.
- Lock the camshaft sprockets with camshaft lock - T10016- in the fit holes in the camshaft housing and secure them against turning ➤ [page 52](#) .
- Remove camshaft sprockets.
- Turn inner part of gasket ring extractor - T10018- two turns (approx. 3 mm) out of the outer part and lock with knurled screw.
- Oil the threaded head of the gasket ring extractor.
- Forcefully screw the gasket ring extractor - T10018- as far as possible into the gasket ring.
- Release knurled screw and turn the inner side against the crankshaft until the gasket ring is pulled out.

Install

- Lightly oil the sealing lip of the gasket ring.

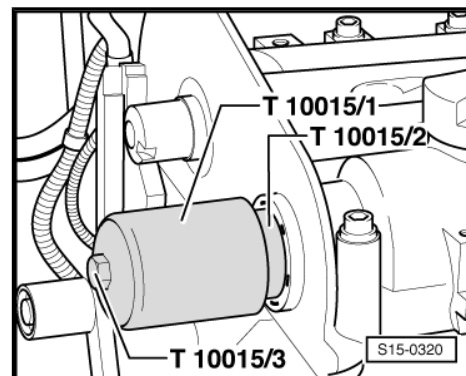


- Place the guide bushing - T10015/2- on the camshaft stub.
- Slide gasket ring over the guide bushing.
- Press in the gasket ring with pressure bushing - T10015/1- and screw -T10015/3- up to the stop.
- Install camshaft sprockets.



Note

Pay attention to the position of the camshaft sprockets relatively to the cotter nuts in the camshafts.



- Lock the camshaft sprockets with camshaft lock - T10016- in the fit holes in the camshaft housing and secure them against turning ⇒ [page 52](#) .
- Tighten new bolts to 20 Nm tightening torque and tighten further 1/4 turn (90°).

Installing the timing belt ⇒ [page 19](#) .

Further installation occurs in reverse order to removal.

2.4 Inspect valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge holder - MP3-447 (VW 387)-
- ◆ Dial gauge



Note

If the valve is replaced when carrying out repair work, use a new valve for the measurement.

Work procedure

- Insert valve into guide. The end of valve stem must be flush with guide. On account of differing stem diameters, only use inlet valve in inlet valve guide and exhaust valve in exhaust valve guide.
- Determine valve rock.

Wear limit: 0.8 mm.

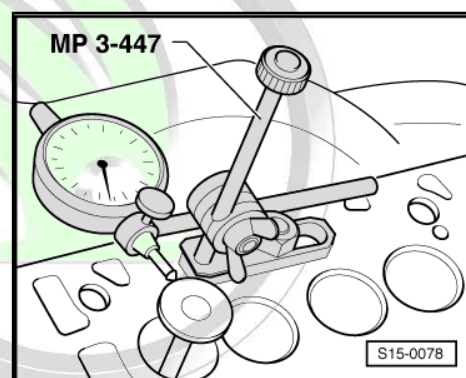


Note

If the wear limit is exceeded, repeat measurement with new valves.

If the valve rock is exceeded:

- Replace the cylinder head.



2.5 Replacing valve stem seals

Special tools and workshop equipment required

- ◆ Pressure hose - MP 1-210 (VW 653/3)-
- ◆ Valve lever - MP 1-211 (VW 541/1A/5) -
- ◆ Assembly device for valves - MP 1-213 (2036)-



- ◆ Valve supporting plate - MP 1-218 -
- ◆ Blank holder for valve spring - MP 1-229 (3362) - with pressure plate - MP 1-229/1 (3362/1)-
- ◆ Valve stem seal extractor - MP 1-230 (3364)-
- ◆ Valve stem seal insertion tool - MP 1-233 (3365)-



Note

With cylinder head removed, use valve supporting plate - MP 1-218- .

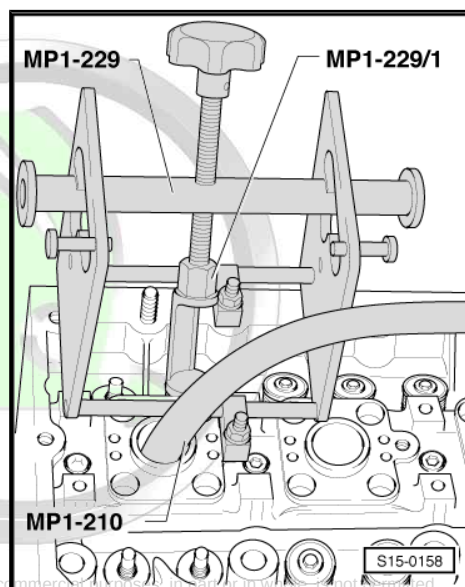
Removing

(with cylinder head installed)

- Removing the camshaft housing ➔ [page 42](#) .
- Remove roller rocker arm and place on a clean surface. Make sure that you do not mix up the roller rocker arms.
- Unscrew the spark plugs with spark plug wrench -3122B- .
- Position piston of the relevant cylinder in bottom dead centre.
- Screw on blank holder for valve spring - MP 1-229- with pressure plate - MP 1-229/1- .
- Screw the pressure hose - MP 1-210- in the spark plug thread.
- Connect pressure hose to compressed air [min. 0.6 MPa (6° bar) overpressure] and remove the valve springs with blank holder for valve spring - MP 1-229- .
- Pull off valve stem gasket with extractor for valve stem seal - MP 1-230- .

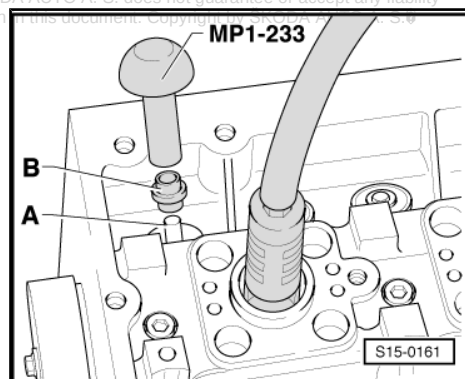
Install

- Insert the supplied plastic bushings on the relevant valve stem. This will prevent any damage to the new valve stem seals.



- Insert the new valve stem seal -B- in the insertion tool for valve stem seal -MP 1-233- .
- Oil the sealing lip of the valve stem seal and carefully slide onto the valve guide -A-.

Further installation occurs in reverse order to removal.



17 – Lubrication

1 Lubrication system



Note

The oil level must not be above the max. marking - risk of damage to catalytic converter!

Inspecting oil pressure ➔ [page 67](#) .

Check the engine oil, amount of oil and oil specification ➔ Maintenance ; Booklet Octavia II.

1.1 Lubrication system - Summary of components

1 - Plug for knock sensor 1 - G61-

2 - Oil pressure switch - F1- , 25 Nm

- ☐ Switching pressure 0.03 ... 0.07 MPa (0.3 ... 0.7 bar)
- ☐ check ➔ [page 67](#)
- ☐ Cut open gasket ring if leaking and replace

3 - 20 Nm

4 - Screw cap

- ☐ for engine identification characters BUD, CGGA

5 - Oil filler inlet with screw cap

- ☐ for engine identification characters BCA
- ☐ Summary of components ➔ [page 62](#)
- ☐ removing and installing ➔ [page 63](#)

6 - Dipstick

- ☐ oil level must not exceed max. marking!

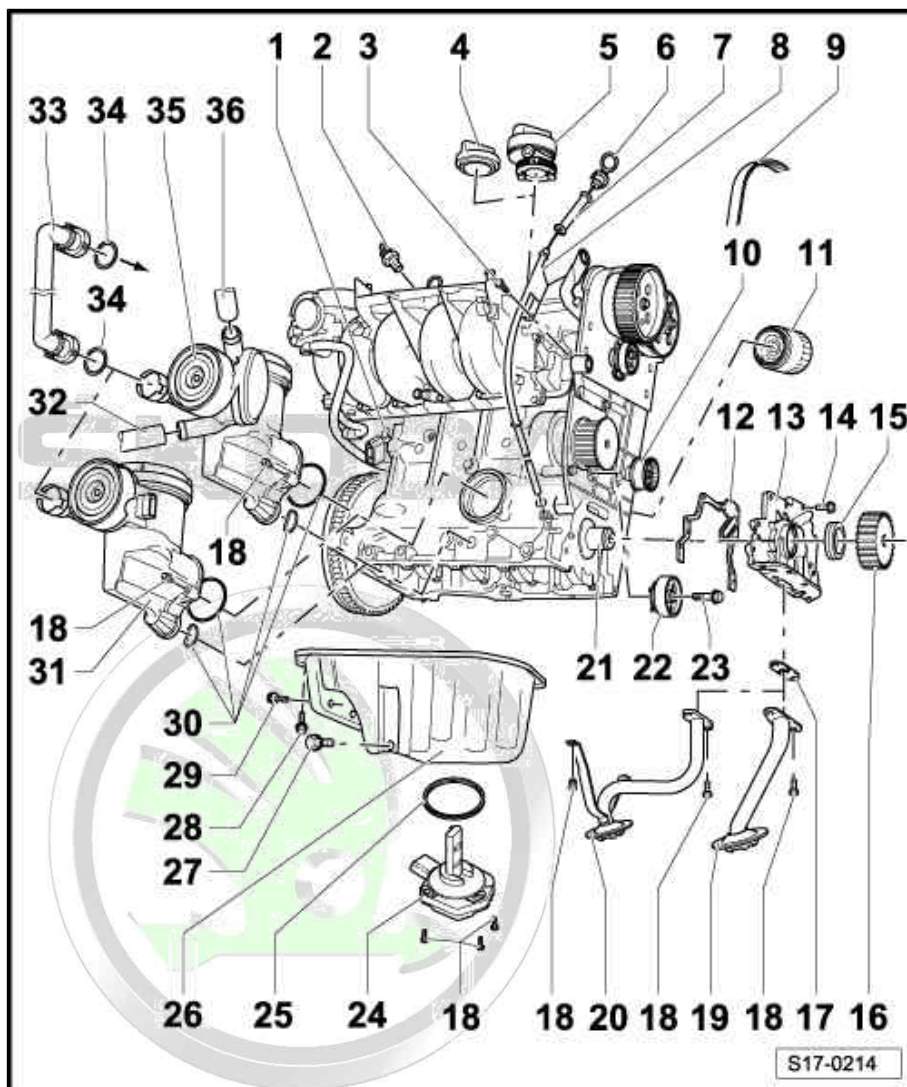
7 - Hopper

- ☐ Remove for extracting oil

8 - Guide tube

9 - Main drive toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ Routing of toothed belt ➔ [page 16](#)
- ☐ removing and installing, tensioning ➔ [page 19](#)



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10 - Guide pulley

- ☐ for main drive toothed belt

11 - Oil filter

- ☐ slacken at hexagon
- ☐ tighten by hand
- ☐ pay attention to installation instructions on oil filter

12 - Gasket

- ☐ must be positioned on dowel sleeves
- ☐ replace

13 - Oil pump

- ☐ must be replaced completely
- ☐ with pressure relief valve, open for an overpressure of approx. 0.45 MPa (4.5 bar)
- ☐ when fitting pay attention to the driver on the crankshaft ➔ [Item 21 \(page 60\)](#)
- ☐ must be positioned on dowel sleeves
- ☐ removing and installing ➔ [page 65](#)

14 - 12 Nm

- ☐ replace

15 - Sealing ring

- ☐ replace ➔ [page 28](#)

16 - Crankshaft - toothed belt sprocket

17 - Gasket

- ☐ replace

18 - 10 Nm

19 - Intake manifold

- ☐ for engine identification characters BUD, CGGA
- ☐ Clean strainer if dirty

20 - Intake manifold

- ☐ for engine identification characters BCA
- ☐ Clean strainer if dirty

21 - Driver

- ☐ coat with oil before installing the oil pump

22 - Main drive tensioning pulley

- ☐ check ➔ [page 25](#)
- ☐ Tensioning toothed belt ➔ [page 19](#)

23 - 20 Nm

24 - Oil level and oil temperature sender -G266-

- ☐ replace if damaged
- ☐ check ➔ Current flow diagrams, Electrical fault finding and Fitting locations

25 - Sealing ring

- ☐ replace

26 - Oil pan

- ☐ clean sealing surface before installing
- ☐ install with sealant - D 176 404 A2-
- ☐ removing and installing ➔ [page 63](#)

27 - Oil drain plug, 30 Nm

- ☐ with captive seal



- ☐ replace

28 - Fixing screws, 13 Nm

- ☐ replace
- ☐ slacken and tighten only the bolts at the flywheel side with socket insert, e. g. - T10058-

29 - 45 Nm

30 - Sealing ring

- ☐ replace

31 - Oil separator

- ☐ for engine identification characters BCA
- ☐ for engine identification characters BUD up to 03/2009
- ☐ with electric heated vacuum regulating valve (PCV valve)
- ☐ Resistance of the heating element at 25 °C: 2.5 - 5.9 Ω

32 - Coolant hose

- ☐ for engine identification characters CGGA
- ☐ for engine identification characters BUD as of 04/2009
- ☐ from coolant pipe ⇒ [page 71](#) ; Pos. 9

33 - Pipe section

- ☐ on engine with identification characters BCA to intake manifold
- ☐ on engines with identification characters BUD, CGGA for crankcase ventilation preheating
⇒ [page 112](#) ; Pos. 15

34 - O-ring

- ☐ replace if damaged

35 - Oil separator

- ☐ for engine identification characters CGGA
- ☐ for engine identification characters BUD as of 04/2009
- ☐ with coolant heated vacuum regulating valve (PCV valve)

36 - Coolant hose

- ☐ for engine identification characters CGGA
- ☐ for engine identification characters BUD as of 04/2009
- ☐ from bottom of coolant expansion reservoir connection



1.2 Oil filler inlet with screw cap - Summary of components (for engine identification characters BCA)

1 - Screw cap

- ☐ Replace seal if damaged

2 - Collar

- ☐ replace if damaged

3 - Oil filler inlet

- ☐ replace if damaged
- ☐ removing and installing
⇒ [page 63](#)

4 - Grommet

- ☐ replace if damaged

5 - Non-return valve

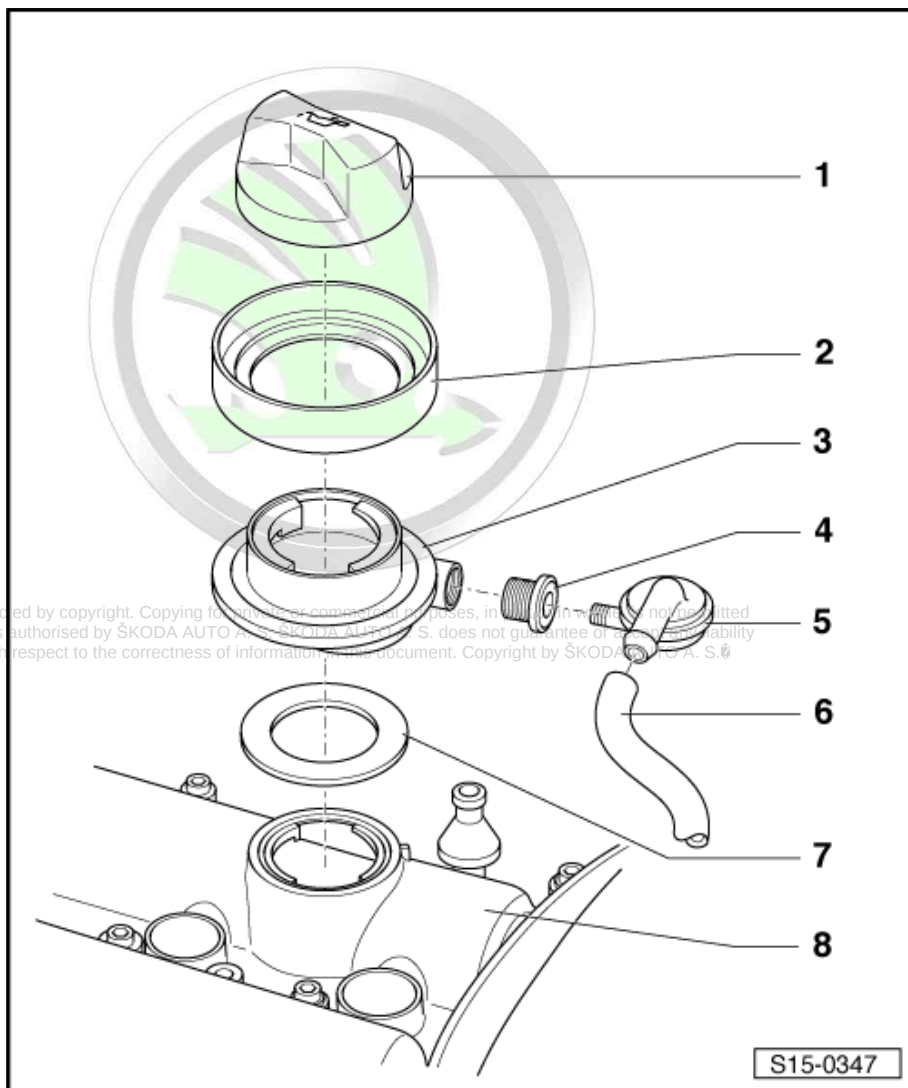
- ☐ Check fitting position

6 - to air filter housing

7 - Gasket

- ☐ replace if damaged

8 - Camshaft housing



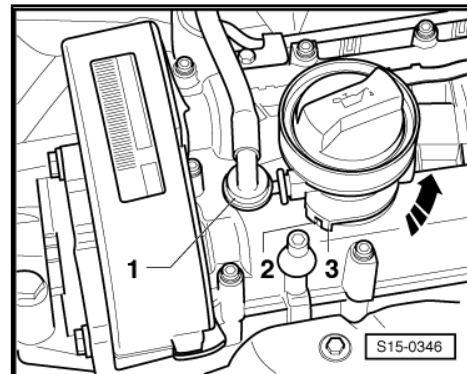
1.3 Removing and installing oil filler inlet with screw cap (for engine identification characters BCA)

Removing

- Disconnect the non-return valve -1- from the oil filler inlet.
- Carefully raise the oil filler inlet and rotate in the -direction of the arrow-.
- Remove the oil filler inlet from the camshaft housing.

Install

- Insert the oil filler inlet into the camshaft housing.
- Turn the filler inlet clockwise, until the groove -3- engages in the peg -2- at the camshaft housing.
- Insert non-return valve.



Note

The oil filler inlet must be slightly raised again so that the groove -3- can engage into the peg -2- at the camshaft housing.

1.4 Removing and installing oil pan

Special tools and workshop equipment required

- ◆ Plug in unit - T10058- or -3249-
- ◆ Sealant remover gasket stripper (bearing code GST, bearing article no. R 34402), manufacturer Retech s.r.o.
- ◆ Cleaning and degreasing agent, e.g. - D 009 401 04-
- ◆ Silicone sealant -D 176 600 A1-

Removing

- Remove the noise insulation.
- Unscrew pre-exhaust pipe from exhaust manifold
⇒ [page 125](#) .
- Disconnect plug from oil level and oil temperature sender - G266- .
- Unscrew two fixing screws from the gearbox flange and the oil pan.
- Drain engine oil.



For engines with identification characters BUD, CGGA

- Unscrew screws -arrows- and remove heat shield from gear-box housing.

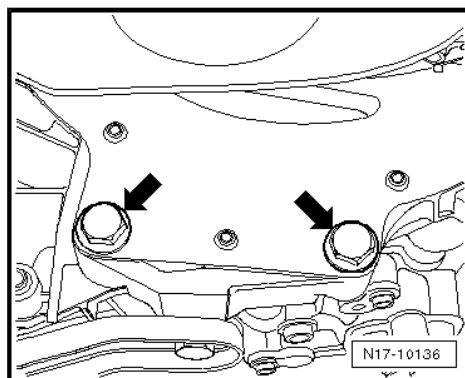
Continued for all vehicles

- Unscrew the sealed oil pan with silicone sealant.
- Remove oil pan. Release oil pan if necessary by applying slight blows with a rubber-headed hammer.



WARNING

Wear protective gloves and goggles when working with gasket remover and degreasing agent!



- Clear sealing surface on cylinder block and on the oil pan from gasket residues with chemical sealant remover.
- Degrease the sealing surfaces.

Install



Note

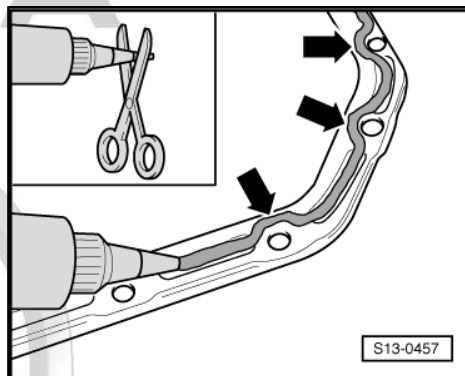
- ♦ *Pay attention to the use by date on sealant.*
- ♦ *The oil pan must be installed within 5 minutes after applying the silicone sealant.*
- ♦ *The oil pan can be better and more securely installed if M6 threaded pins are inserted as guides in two locations on the cylinder block flange.*

- Cut off nozzle tube at the front marking ($\varnothing$ of nozzle approx. 3 mm).
- Apply silicone sealant to the clean sealing surface of the oil pan, as shown in the illustration. Sealant bead must:
 - ♦ be 2...3 mm thick
 - ♦ run past the area around the bolt holes on the inside -arrows-



Note

The sealant bead must not be thicker otherwise excess sealant may get into the oil pan and clog the strainer in the oil suction pipe.



- Fit oil pan immediately and lightly tighten all oil pan screws.
- Tighten oil pan screws to tightening torque: 13 Nm
- Tighten up the bolts on the oil pan/gearbox to a torque of 45 Nm.

For engines with identification characters BUD, CGGA

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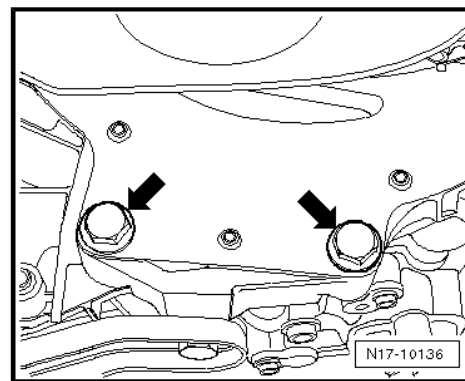
- Position the heat shield onto gearbox housing and tighten the fixing screws -arrows- to 40 Nm.

Continued for all vehicles



Note

After installing the oil pan, allow the sealant to dry for about 30 minutes. Only then may engine oil be filled in.



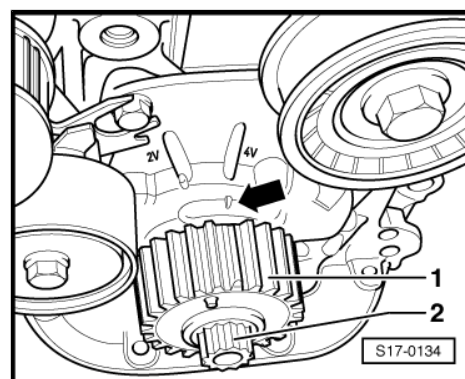
1.5 Removing and installing oil pump

Special tools and workshop equipment required

- ◆ Socket - T10022-
- ◆ Retractor - MP1-207-
- ◆ Sealant remover gasket stripper (bearing code GST, bearing article no. R 34402), manufacturer Retech s.r.o.
- ◆ Cleaning and degreasing agent, e.g. - D 009 401 04-

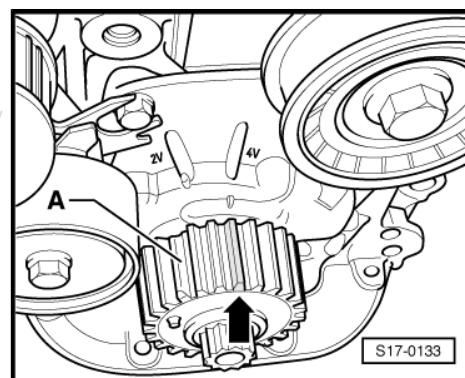
1.5.1 Removing

- Remove main drive toothed belt ➔ [page 16](#) .
- Secure crankshaft - toothed belt sprocket -1- to the crankshaft with fixing screw -2-.
- Position crankshaft on TDC for cylinder 1:
- The chamfered tooth of the toothed belt must correspond with the marking on the oil pump -arrow-.



- Turn the crankshaft or toothed belt sprocket from TDC three teeth anti-clockwise.

- The third tooth -arrow- of the toothed belt sprocket on the right next to the chamfered tooth -A- must be flush with the TDC marking at the oil pump housing.





Note

Turning will give the crankshaft the fitting position for the oil pump.
One of the four driver polygonal cams -arrow- on the crankshaft must be located at the top.

- Remove main drive tensioning pulley.
- Removing the oil pan ⇒ [page 63](#) .
- Remove oil suction pipe.
- Remove crankshaft - toothed belt sprocket.
- Remove oil pump.
- Remove gasket ring.



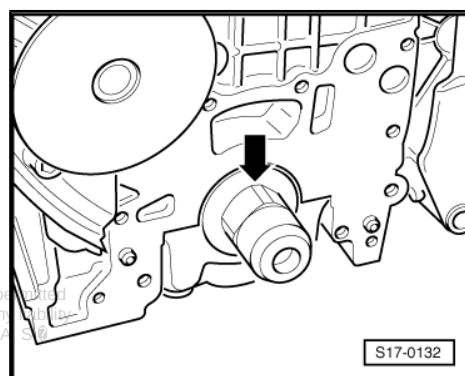
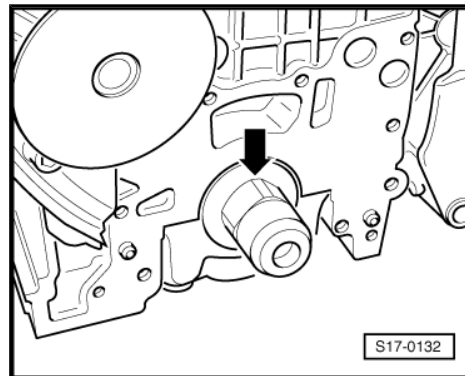
WARNING

Wear protective gloves and goggles when working with gasket remover and degreasing agent!

- Clear sealing surface on cylinder block and on the oil pump from gasket residues with chemical sealant remover.
- Degrease the sealing surfaces.

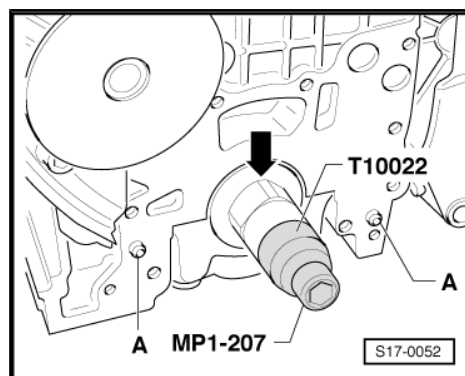
1.5.2 Install

- One of the four driver polygonal cams -arrow- on the crankshaft is located at the top.

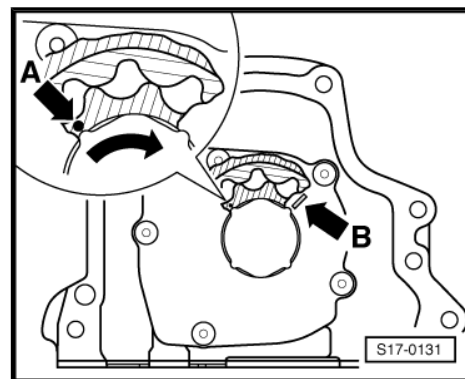


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- Position the bushing -T10022- on the crankshaft and tighten the Allan screw of the inserting device -MP 1-207- by hand.
- Insert new seal on the dowel sleeves -A-.



- Position the marking -arrow A- of the inside rotor of the oil pump to the marking for the fitting position -arrow B- of the oil pump housing cover.
- Coat the polygonal cam of the crankshaft with oil.
- Lightly oil the gasket ring of the oil pump.
- Carefully push the oil pump onto the driver polygon cam of the crankshaft.
- If necessary align the pump rotor with the driver polygonal cam of the crankshaft by turning slightly.
- Subsequently, carefully slide the oil pump over the dowel sleeves.
- Tighten the oil pump with new screws. Tightening torque: 12 Nm.
- Remove assembly device - T10022- .



Further installation occurs in reverse order to removal.

1.6 Testing oil pressure and oil pressure switch - F1-

Special tools and workshop equipment required

- ♦ Oil pressure tester , e.g. -V.A.G 1342-
- ♦ Voltage tester , e. g. -V.A.G 1527 -
- ♦ Measuring tool set , e.g. -V.A.G 1594 C -



Note

Functional test and repair of the visual and acoustic oil pressure display ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Test sequence

- Remove oil pressure switch -F1- and screw into testing device.
- Screw tester in the cylinder head instead of the oil pressure switch.
- Connect brown cable of tester to earth (-).
- Connect voltage tester to battery positive terminal (+) and to oil pressure switch.

If the LED lights up:

- Replace oil pressure switch - F1- .

If the LED does not light up:

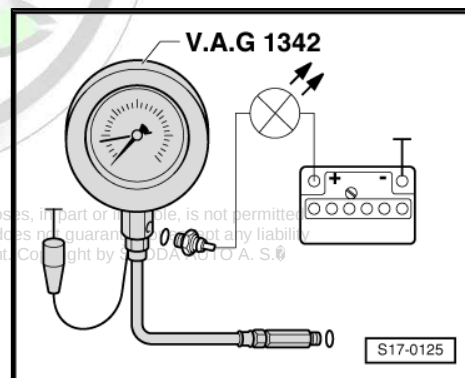
- Start engine and slowly increase engine speed.

Given an oil pressure of 0.03...0.07 MPa (0.3...0.7 bar) the LED must light up, otherwise replace the oil pressure switch.

- Increase engine speed further.

At an engine speed of 2000 rpm and an oil temperature of 80° C the oil pressure should be at least 0.2 MPa (2 bar).

At a higher engine speed the oil pressure must not be greater than 0.7 MPa (7 bar).





19 – Cooling

1 Cooling system



WARNING

Hot steam or hot coolant may escape when the compensation bottle is opened. Cover the cap with a cloth and open carefully.

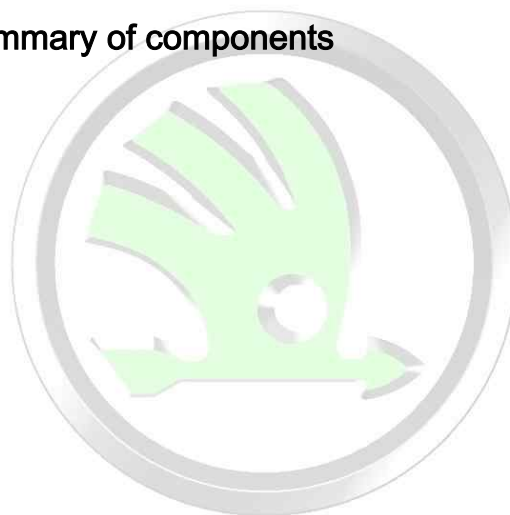


Note

- ◆ *When the engine is warm the cooling system is under pressure. If necessary reduce pressure before repairs.*
- ◆ *The hose connections are secured with spring-type clips. In the event of repairs only use spring-type clips.*
- ◆ *Use pliers for spring strap clips to fit the spring strap clips.*
- ◆ *Always replace seals and gasket rings.*
- ◆ *When installing fit the coolant hoses free of stress, without them touching any other components (pay attention to the markings on the coolant connections).*
- ◆ *The arrows which are on the coolant pipes and the coolant hose ends must stand opposite to each other.*

1.1 Parts of the cooling system fitted to body

1.1.1 Radiator with a radiator fan - Summary of components



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1 - Top coolant hose

- ☐ To connection fitting at cylinder head

2 - O-ring

- ☐ replace

3 - Radiator

- ☐ removing and installing
⇒ [page 75](#)
- ☐ after replacing fill entire system with fresh coolant

4 - Gasket

5 - Screw cap

- ☐ Check pressure relief valve ⇒ [page 77](#)

6 - Connector

7 - 2 Nm

8 - Expansion reservoir

- ☐ Check the cooling system for tightness
⇒ [page 77](#)

9 - Support

- ☐ for radiator

10 - 5 Nm

11 - Support

12 - Radiator fan - V7-

13 - Fan shroud

- ☐ removing and installing
⇒ [page 75](#)

14 - 5 Nm

15 - 5 Nm

16 - Connector

17 - Bottom coolant hose

- ☐ to the connection fitting for the coolant regulator

18 - Retaining clip

19 - Thermoswitch/senders

Depending upon vehicle equipment:

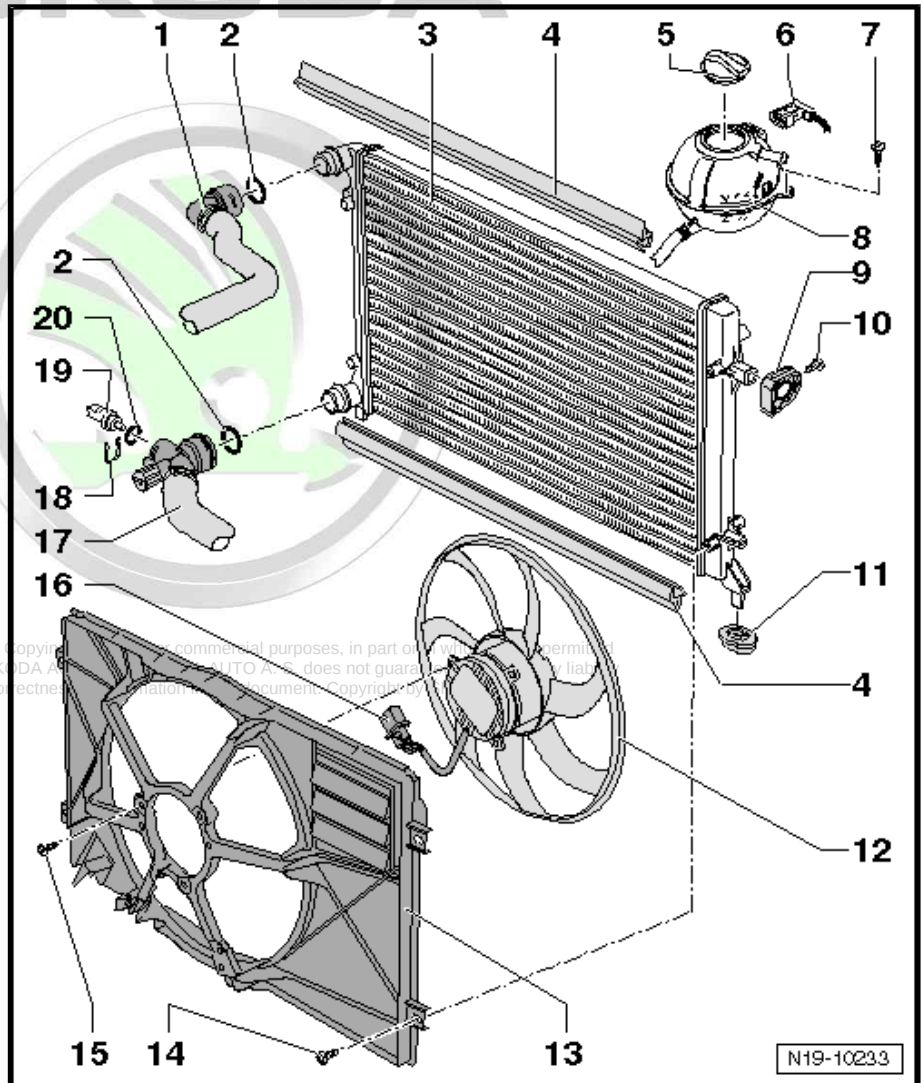
- ☐ Thermoswitch for radiator fan - F18-
- ☐ three-pin plug

switching temperatures:

- ☐ 1. Stage: 92 - 97 °C on; 84 °C off
- ☐ 2. Stage: 99 - 105 °C on; 91 °C off

or

- ☐ Coolant temperature sender at radiator outlet - G83-
- ☐ two-pin plug





20 - O-ring

- ☐ replace

1.1.2 Radiator with two radiator fans - Summary of components

1 - Top coolant hose

- ☐ check tightness

2 - O-ring

- ☐ replace

3 - Radiator

- ☐ removing and installing
⇒ [page 75](#)
- ☐ after replacing fill entire system with fresh coolant

4 - Gasket

5 - Screw cap

- ☐ Check pressure relief valve ⇒ [page 77](#)

6 - Connector

7 - 2 Nm

8 - Expansion reservoir

- ☐ Check the cooling system for tightness
⇒ [page 77](#)

9 - Support

- ☐ for radiator

10 - 5 Nm

11 - Support

12 - Fan shroud

- ☐ removing and installing
⇒ [page 75](#)

13 - Radiator fan 2 - V35-

14 - Radiator fan - V7-

15 - Bottom coolant hose

- ☐ check tightness

16 - Retaining clip

17 - Thermoswitch/senders

Depending upon vehicle equipment:

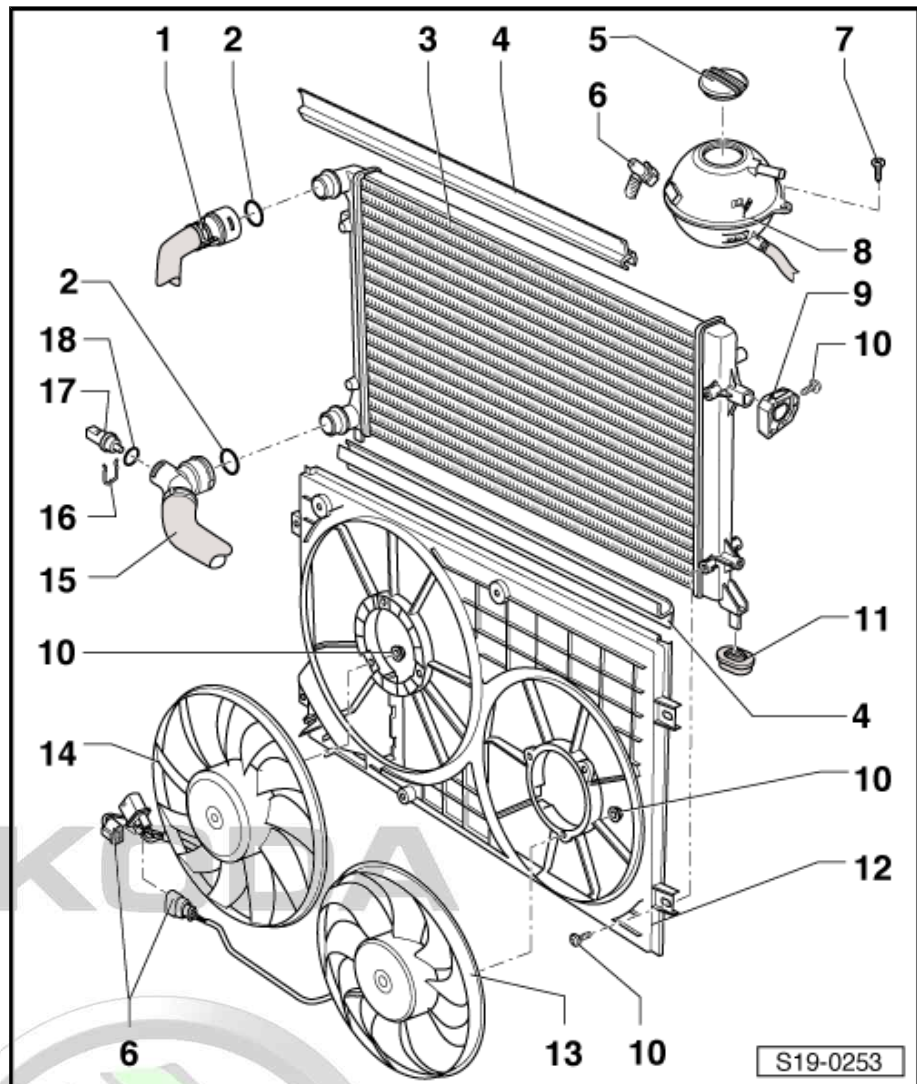
- ☐ Thermoswitch for radiator fan - F18-
- ☐ three-pin plug

switching temperatures:

- ☐ 1. Stage: 92 - 97 °C on; 84 °C off
- ☐ 2. Stage: 99 - 105 °C on; 91 °C off

or

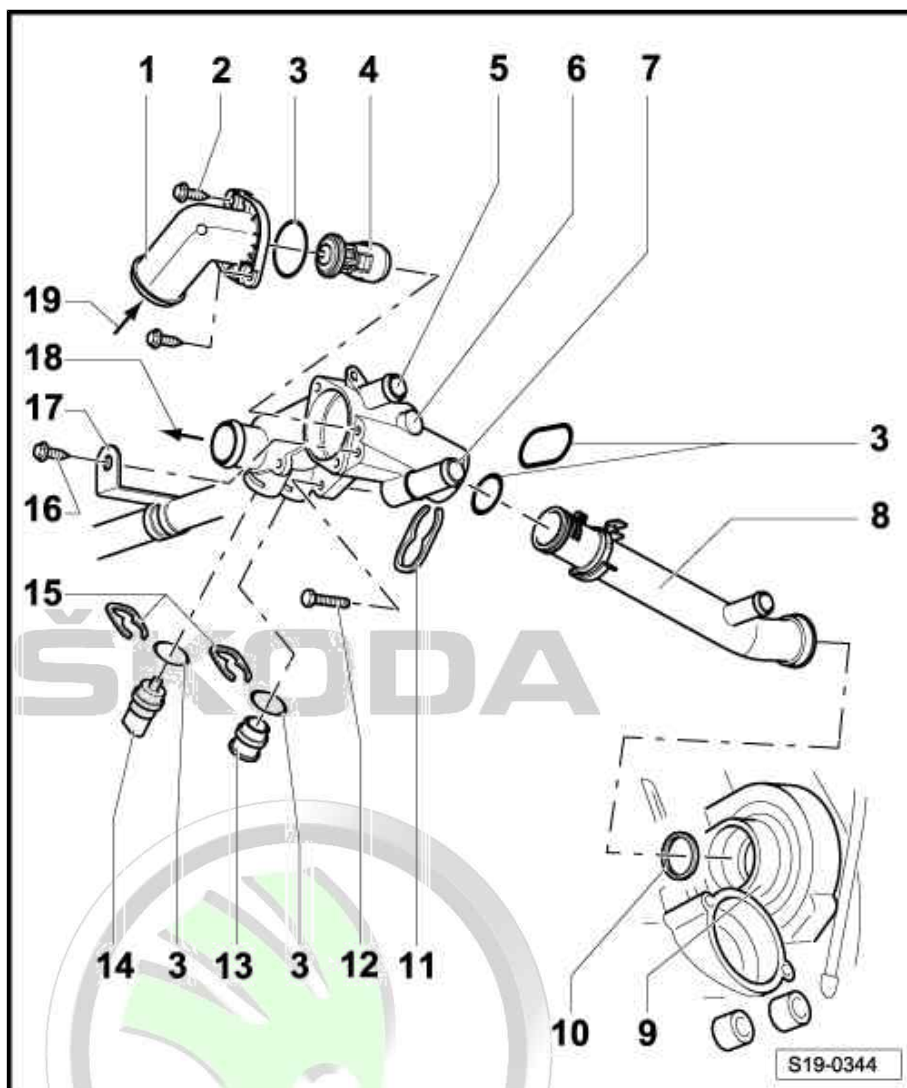
- ☐ Coolant temperature sender at radiator outlet - G83-



- ☐ two-pin plug
- 18 - O-ring**
 - ☐ replace

1.2 Coolant regulator - Summary of components

- 1 - Connection fittings**
- 2 - Self-tapping screw, 7 Nm**
- 3 - O-ring**
 - ☐ replace
- 4 - Coolant regulator**
 - ☐ test: Heat up regulator in a water bath
 - ☐ Start of opening: approx. 84 °C
 - ☐ End of opening: approx. 98 °C
 - ☐ Opening stroke: min. 7 mm
- 5 - to heat exchanger**
 - ☐ connection diagram for coolant hoses
⇒ [page 73](#)
- 6 - Coolant regulator housing**
- 7 - from heat exchanger**
 - ☐ Connection diagram for coolant hoses
- 8 - Coolant pipe**
 - ☐ connection diagram for coolant hoses
⇒ [page 73](#)
- 9 - Cooling pump housing at cylinder block**
- 10 - Sealing ring**
 - ☐ replace
- 11 - Retaining clip**
 - ☐ check tightness
- 12 - 10 Nm**
- 13 - Screw cap**
 - ☐ before removing, reduce pressure in cooling system if necessary
- 14 - Coolant temperature sender -G62-**
 - ☐ before removing, reduce pressure in cooling system if necessary
- 15 - Retaining clip**
 - ☐ check tightness
- 16 - Self-tapping screw, 7 Nm**
 - ☐ for engine identification characters BCA up to 05/2005
- 17 - Connecting pipe**
 - ☐ for exhaust gas recirculation



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- ☐ for engine identification characters BCA up to 05/2005

18 - to bottom radiator

- ☐ connection diagram for coolant hoses ➔ [page 73](#)

19 - from top radiator

- ☐ connection diagram for coolant hoses ➔ [page 73](#)

1.3 Coolant pump - Summary of components

1 - Main drive toothed belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ Routing of toothed belt ➔ [page 16](#)
- ☐ removing and installing, tensioning ➔ [page 19](#)

2 - Coolant pump

- ☐ check smooth operation
- ☐ if damage and leak present, replace complete
- ☐ removing and installing ➔ [page 79](#)

3 - 10 Nm

4 - Rear toothed belt guard

5 - Top toothed belt guard

6 - Bottom toothed belt guard

7 - 12 Nm

- ☐ replace

8 - Belt pulley

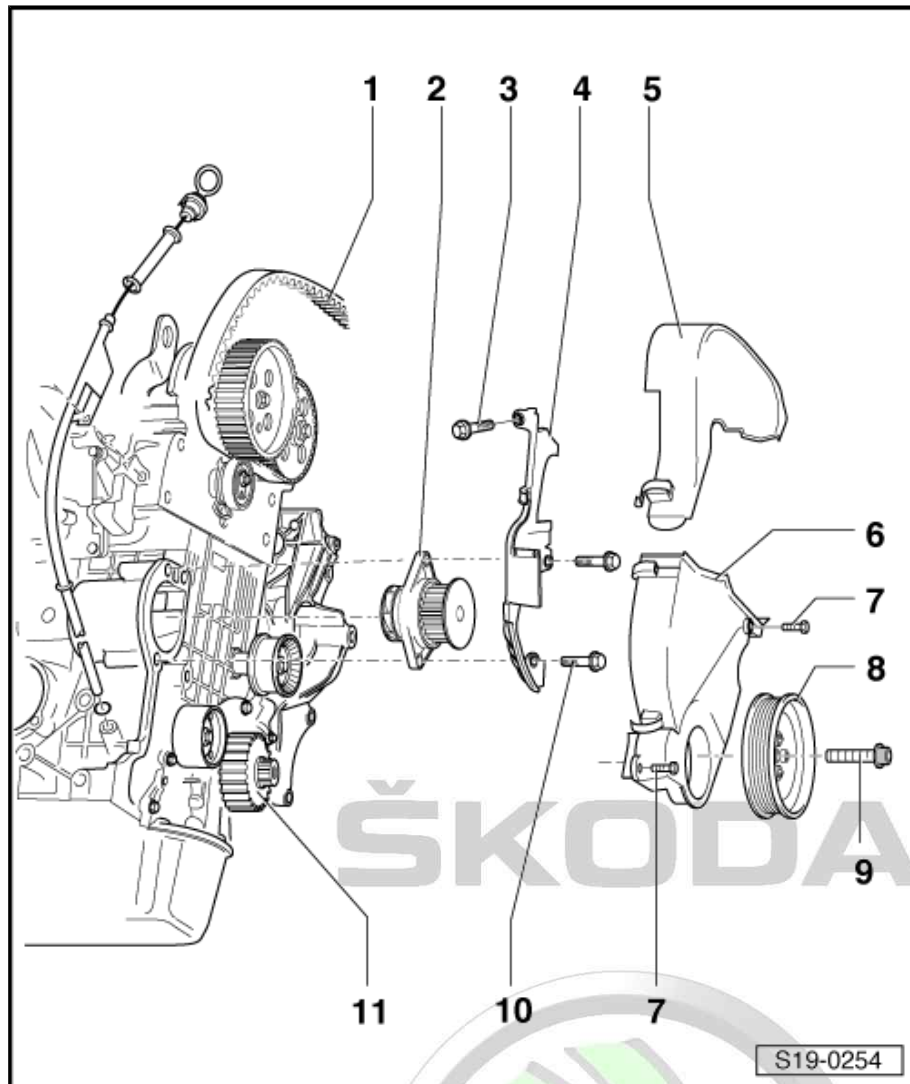
- ☐ removing and installing ➔ [page 16](#)
- ☐ pay attention to the locating element when installing
- ☐ Removing and installing ribbed V-belt ➔ [page 15](#)

9 - Turn a further 150 Nm + 1/2 turns (180°).

- ☐ replace
- ☐ The contact surfaces of the fixing screw and the belt pulley must be free of grease and oil
- ☐ Oil the thread of the screw
- ☐ Counterhold belt pulley with counterholder - T30004 (3415)- with bolt -T30004/1 (3415/1)-
- ☐ tightening may occur in successive stages
- ☐ the torquing angle can be measured with a commercially available angle measuring plate, e.g. -Hazet 6690-

10 - 20 Nm

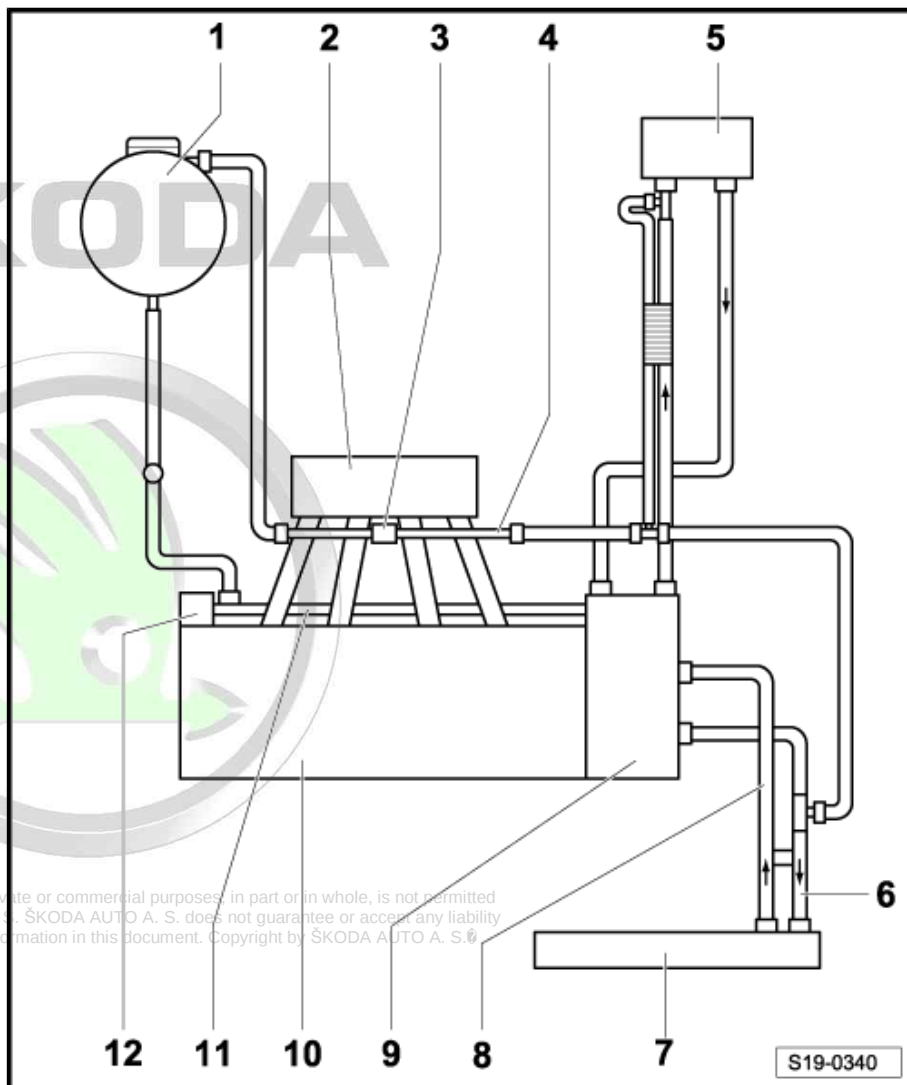
11 - Crankshaft - toothed belt sprocket



1.4 Connection diagram for coolant hoses

1.4.1 For engine with identification characters BUD up to 03/2009 and BCA

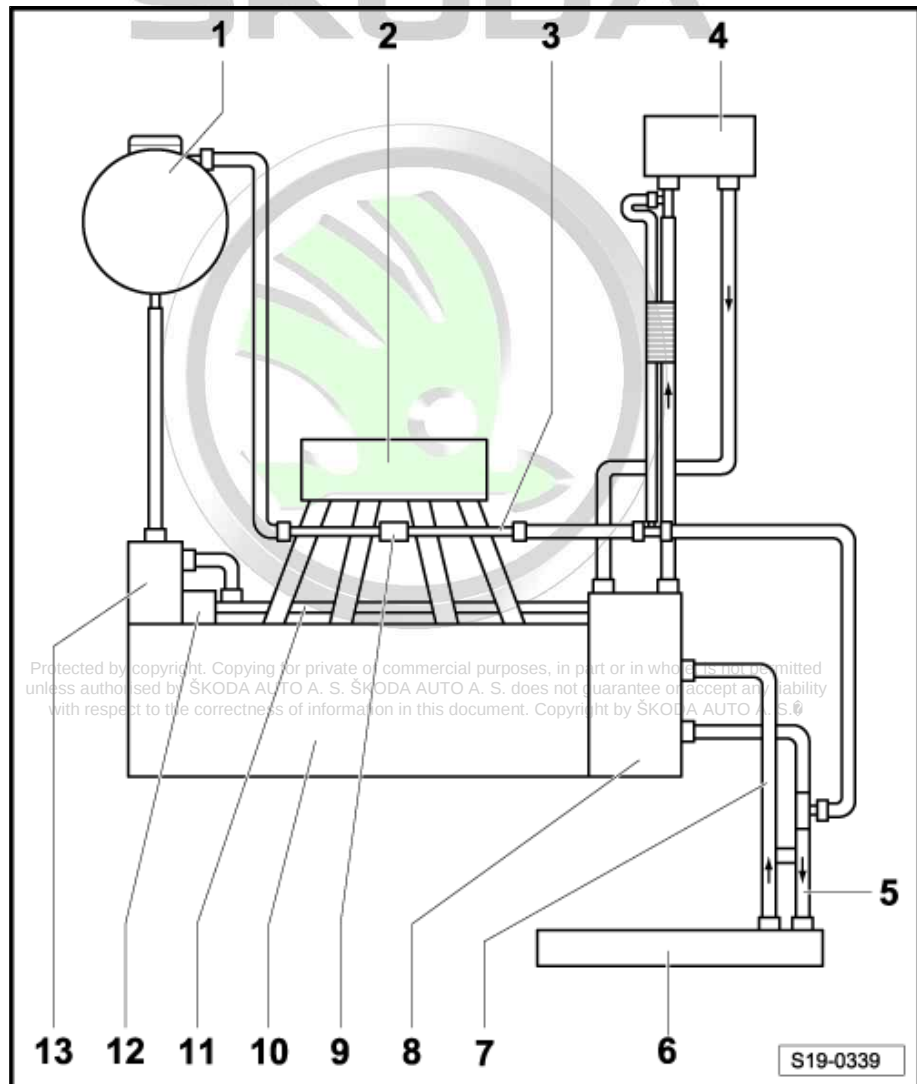
- 1 - Expansion reservoir
- 2 - Intake manifold
- 3 - Preheating for crankcase ventilation
 - ☐ only on engine with identification characters BUD
- 4 - Top coolant pipe
 - ☐ screwed onto camshaft housing
- 5 - Heat exchanger of heating system
- 6 - Top coolant hose
- 7 - Radiator
- 8 - Bottom coolant hose
- 9 - Coolant regulator housing
- 10 - Cylinder head/cylinder block
- 11 - Coolant pipe below
- 12 - Coolant pump





1.4.2 For engines with identification characters BUD as of 04/2009 and CGGA

- 1 - Expansion reservoir
 - 2 - Intake manifold
 - 3 - Top coolant pipe
 - 4 - Heat exchanger of heating system
 - 5 - Top coolant hose
 - 6 - Radiator
 - 7 - Bottom coolant hose
 - 8 - Coolant regulator housing
 - 9 - Preheating for crankcase ventilation
 - 10 - Cylinder head/cylinder block
 - 11 - Coolant pipe below
 - 12 - Coolant pump
 - 13 - Oil separator
- ☐ with coolant heated vacuum regulating valve (PCV valve)



1.5 Draining and filling up coolant

Special tools and workshop equipment required

- ◆ Catch pan, e.g. - V.A.G 1306-
- ◆ Pliers for spring strap clamps
- ◆ Refractometer - T10007- or -T10007A-

Draining



WARNING

Hot steam may escape when the compensation bottle is opened. Cover the cap with a cloth and open carefully.

- Open the cap of the coolant expansion reservoir.
- Remove the noise insulation.

- Remove coolant hose at bottom of radiator -arrow-.

Filling up



Note

- ◆ *Used coolant must not be reused.*
- ◆ *Replace O-rings.*

- Connect coolant hose at bottom of radiator.
- Install the noise insulation.

Select the appropriate coolant additive from the ⇒ Electronic Catalogue of Original Parts or from the list of allowed coolant additives ⇒ Maintenance ; Booklet Octavia II .

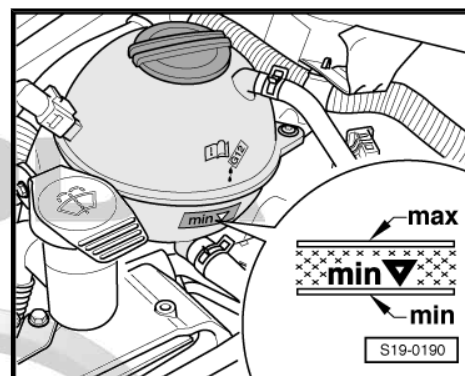
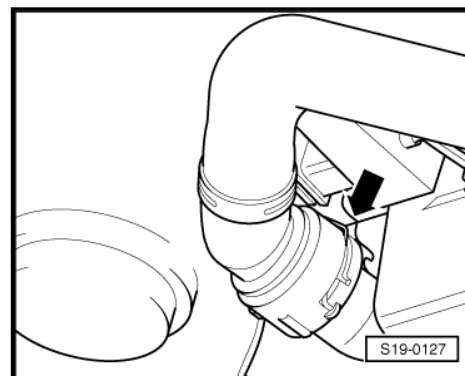
- In a clean reservoir, mix distilled water and anti-freeze in the specified mixing ratio ⇒ Maintenance ; Booklet Octavia II .
- Fill up coolant up to max. marking on the expansion reservoir.
- Seal expansion reservoir.
- Start engine and run engine until the fan starts.



WARNING

Hot steam may escape when the compensation bottle is opened. Cover the cap with a cloth and open carefully.

- Check the level of coolant and top up if necessary. When engine is at operating temperature the coolant level must be at the “max” marking, when engine is cold between the “min” and “max” markings.



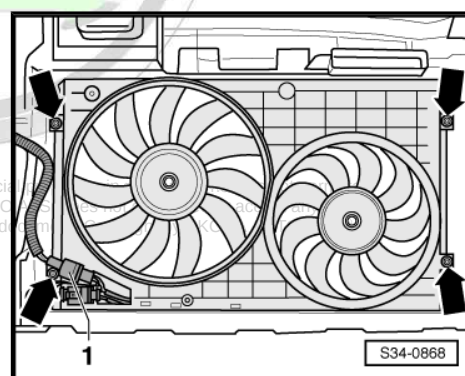
1.6 Removing and installing fan shroud for radiator fan - V7- and -V35-

Removing

- Remove the noise insulation.
- Separate plug connection -1- and unscrew fixing bolts for fan shroud -arrows-.
- Remove fan shroud with fans downwards.

Install

Installation is carried out in the reverse order. Copying for private or commercial use without the written permission of ŠKODA AUTO A. S. ŠKODA AUTO A. S. is not responsible for the correctness of information in this document.



1.7 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Catch pan, e.g. - V.A.G 1306-
- ◆ Pliers for spring strap clamps



- ♦ antifreeze tester

Removing

- Drain coolant ⇒ [page 74](#) .
- Disconnect plug from thermoswitch or sender on the coolant hose support at bottom of radiator.
- Remove fan shroud for radiator fan - V7- and - V35 - ⇒ [page 75](#) .
- Remove coolant hose at top radiator.

Vehicles without air conditioning

- Unscrew fixing screws for radiator bearing on right and left ⇒ [page 68](#) ; Pos. 10.
- Unhook the radiator out of the lower bearings and remove it downwards.

Vehicles with air conditioning

- Remove front bumper ⇒ Body Work; Rep. gr. 63 .
- Unscrew fixing screws for radiator bearing on right and left ⇒ [page 70](#) ; Pos. 10.



WARNING

Do not open the refrigerant circuit of the air conditioning system.

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Caution

In order to avoid damage to the condenser as well as to the refrigerant lines and hoses, ensure that the lines and hoses are not over-tensioned, kinked or bent.



Note

For the following work, a second mechanic is required to hold the radiator.

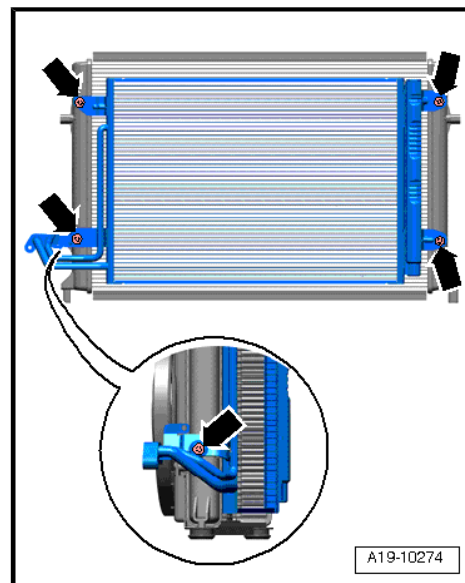
- Swivel the radiator towards the rear, remove the bearings on the sides and unhook from the bottom bearings.

- Release the securing bolts -arrows- of the condenser.
- Remove radiator downwards.

Install

Installation is carried out in the reverse order. Pay attention to the following:

- Top up coolant ➔ [page 74](#) .



1.8 Checking the coolant system for leak-tightness

1.8.1 Inspecting coolant system with cooling system testing device - V.A.G 1274- for tightness

Special tools and workshop equipment required

- ◆ Cooling system testing device , e.g. -V.A.G 1274-
- ◆ Adapter for cooling system testing device , e.g. -V.A.G 1274/8-
- ◆ Adapter for cooling system testing device , e.g. -V.A.G 1274/9-

Test condition

- Engine must be warm.

Test sequence



WARNING

Hot steam may escape when the compensation bottle is opened.

- ◆ *Wear safety goggles and safety clothing, in order to avoid eye injuries and scalding.*
- ◆ *Cover the cap with a cloth and open carefully.*

- Open compensation bottle.



- Position the cooling system testing device - V.A.G 1274- with adapter - V.A.G 1274/8- on the coolant expansion reservoir.
- Using the hand pump of the testing device generate an over-pressure of approx. 0.1 MPa (1.0 bar).

If the pressure drops:

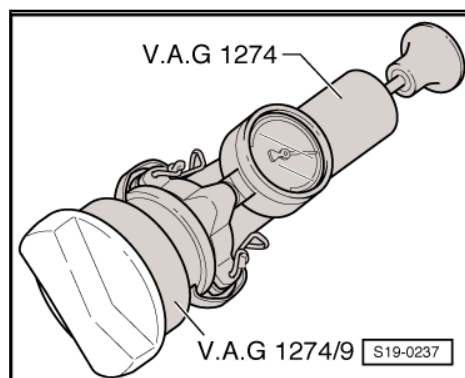
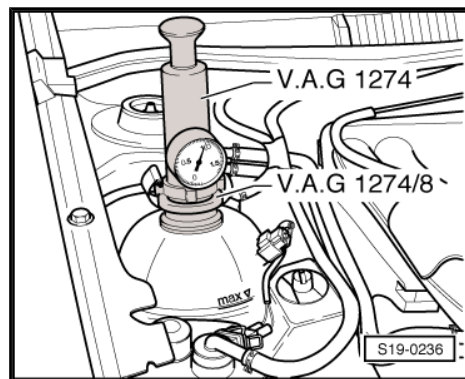
- Search position of the leak and repair fault.

Testing the pressure relief valve in the cap

- Position the cooling system testing device - V.A.G 1274- with adapter - V.A.G 1274/9- on the cap.
- Operate the handpump.
- The pressure relief valve should open at a pressure of 0.14...0.16 MPa (1.4...1.6 bar).

If the pressure relief valve opens too early or too late

- Replace cap.



1.8.2 Inspecting coolant system with cooling system testing device - V.A.G 1274 B- for tightness

Special tools and workshop equipment required

- ◆ Cooling system testing device , e.g. -V.A.G 1274 B-
- ◆ Adapter for cooling system testing device , e.g. -V.A.G 1274/8-
- ◆ Adapter for cooling system testing device , e.g. -V.A.G 1274/9-

Test condition

- Engine must be warm.

Test sequence



WARNING

Hot steam may escape when the compensation bottle is opened.

- ◆ *Wear safety goggles and safety clothing, in order to avoid eye injuries and scalding.*
- ◆ *Cover the cap with a cloth and open carefully.*

- Open compensation bottle.
- Screw the adapter for cooling system testing device - V.A.G 1274/8- into the coolant expansion bottle.
- Clamp the connecting piece - V.A.G 1274 B/1- in the adapter for cooling system testing device - V.A.G 1274/8-

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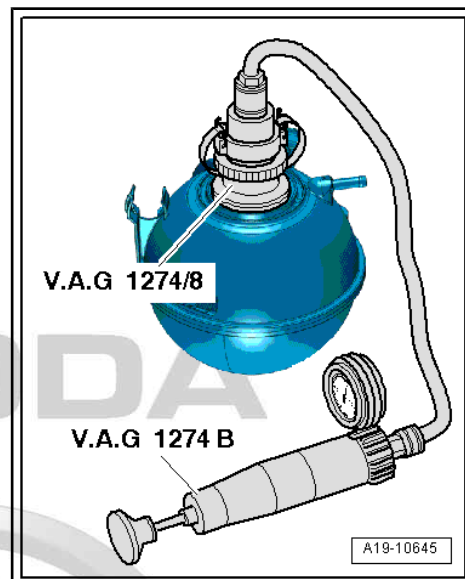
- Connect the connecting piece - V.A.G 1274 B/1- via the delivered connecting hose to the cooling system testing device - V.A.G 1274 B- .
- Using the hand pump of the testing device generate an over-pressure of approx. 0.1 MPa (1.0 bar).



WARNING

Risk of scalding!

- ◆ *Before the cooling system testing device - V.A.G 1274 B- is separated from the connecting hose or the connecting piece - V.A.G 1274 B/1- , the existing pressure must absolutely be released.*
- ◆ *For this step, press the pressure relief valve on the cooling system testing device - V.A.G 1274 B- and hold it pressed until the pressure gauge indicates the value »0«.*



If the pressure drops:

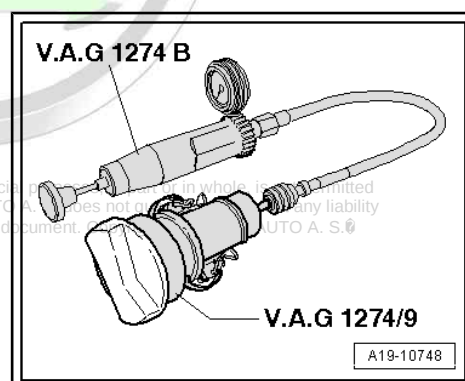
- Search position of the leak and repair fault.

Testing the pressure relief valve in the cap

- Screw the screw cap into the adapter for cooling system testing device - V.A.G 1274/9- .
- Clamp the connecting piece - V.A.G 1274 B/1- in the adapter for cooling system testing device - V.A.G 1274/9- .
- Connect the connecting piece - V.A.G 1274 B/1- via the delivered connecting hose to the cooling system testing device - V.A.G 1274 B- .
- Operate the handpump.
- The pressure relief valve should open at a pressure of 0.14...0.16 MPa (1.4...1.6 bar).

If the pressure relief valve opens too early or too late

- Replace cap.



1.9 Removing and installing coolant pump

Special tools and workshop equipment required

- ◆ Catch pan, e.g. - V.A.G 1306-
- ◆ Pliers for spring strap clamps

Removing



Note

- ◆ *The integrated gasket of the coolant pump must not be removed from the pump.*
- ◆ *If leak and damage present, replace the coolant pump with gasket completely.*
- ◆ *Cover the toothed belt with a cloth before removing the coolant pump in order to protect it from the coolant.*

- Drain coolant ➔ [page 74](#) .
- Remove main drive toothed belt ➔ [page 19](#) .

For engine with identification characters BCA

- Remove guide pulley -6-; to this end release the fixing screw -5- of the guide pulley.

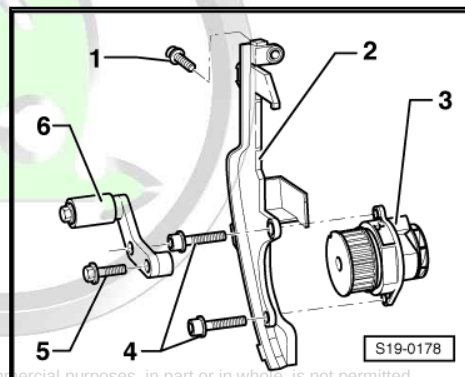
Continued for all vehicles

- Unscrew the fixing screw -1- of the toothed belt guard at rear.
- Unscrew the fixing screws -4- of the coolant pump and remove the toothed belt guard at rear -2- and the coolant pump -3-.

Install

Installation is performed in the reverse order, pay attention to the following points:

- Position the coolant pump -3- in the cylinder block and install fixing screws -4- together with rear toothed belt guard.
- Tighten fixing screws -4- to 20 Nm and -1- to 10 Nm.



For engine with identification characters BCA

- Install guide pulley -6- and tighten the fixing screw -5-. Tightening torque: 50 Nm.

Continued for all vehicles

- Install timing belt and tension ➔ [page 21](#) .
- Top up coolant ➔ [page 74](#) .

20 – Fuel supply system

1 Fuel supply system

1.1 Fuel tank with component parts - Summary of components



Note

- ◆ *Fuel hoses at the engine must only be secured with spring-type clips. The use of clamp-type or screw-type clips is not allowed.*
- ◆ *We recommend use of the fuel extraction device to empty the fuel tank.*
- ◆ *Use pliers for spring strap clips to fit the spring strap clips.*

Observe safety measures ➔ [page 2](#) .

Observe rules for cleanliness ➔ [page 2](#) .

Inspecting the electronic power control (electronic throttle)
➔ [page 104](#) .

Activated charcoal container system - Summary of components
➔ [page 107](#) .



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1 - Mounting part

2 - Screw cap

- ☐ replace if damaged

3 - Earth connection

4 - 11 Nm

5 - Support

6 - Fuel tank

- ☐ removing and installing
⇒ [page 89](#)

7 - 25 Nm

8 - Circlip

9 - Tensioning strap

- ☐ Check fitting position

10 - Heat shield

11 - Fuel filter with fuel pressure regulator

- ☐ Fitting position: arrow points in direction of flow
- ☐ Summary of components ⇒ [page 84](#)
- ☐ removing and installing

12 - Feed line

- ☐ to fuel rail
- ☐ check for firm seating

13 - Vent line

- ☐ clipped in place on the side of the fuel tank
- ☐ check for firm seating

14 - Sealing ring

- ☐ replace
- ☐ moisten with fuel before installing

15 - Fuel delivery unit

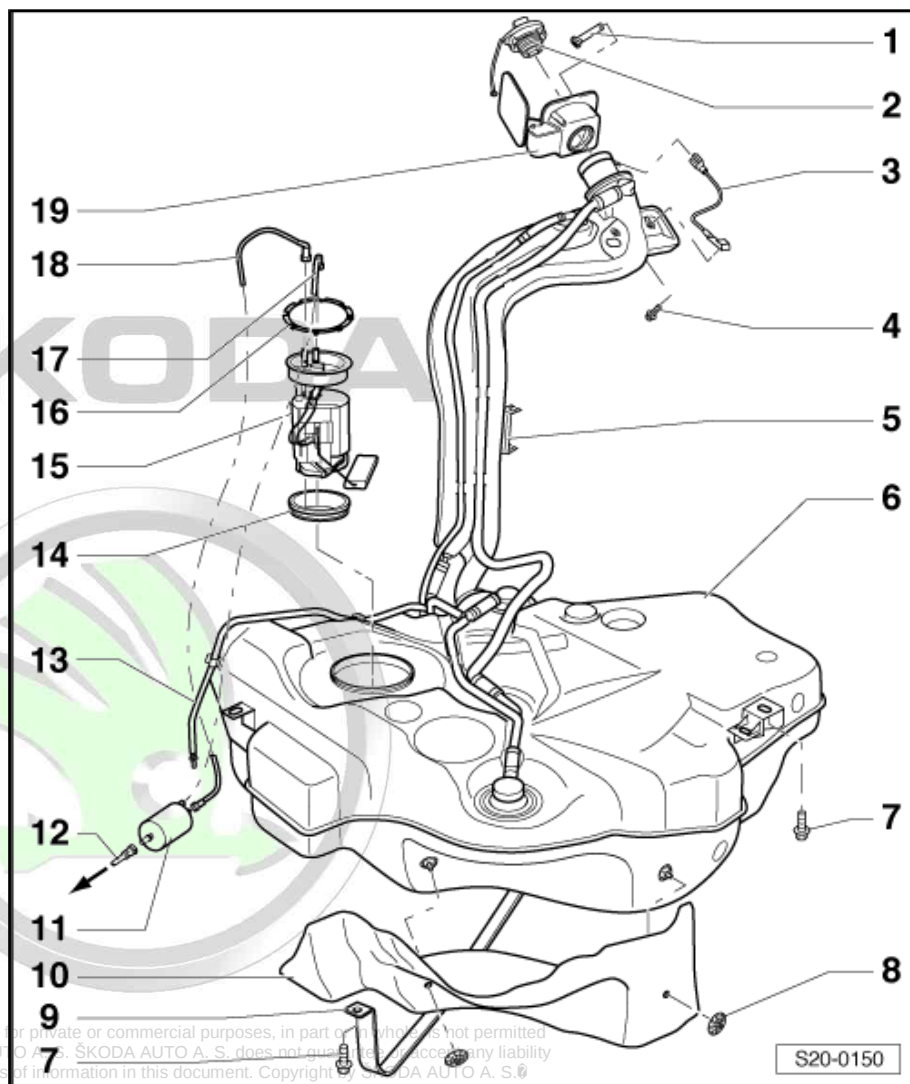
- ☐ removing and installing ⇒ [page 85](#)
- ☐ inspecting fuel pump ⇒ [page 91](#)
- ☐ Fitting position of flange of fuel delivery unit up to 05/2010 ⇒ [page 83](#)
- ☐ Fitting position of flange of fuel delivery unit as of 06/2010 ⇒ [page 83](#)
- ☐ with sender -G- for fuel gauge
- ☐ removing and installing the sender for fuel gauge ⇒ [page 88](#)
- ☐ Clean strainer if dirty

16 - Lock ring, 110 Nm

- ☐ check for firm seating
- ☐ use wrench - T30101 (3087)- for removing and installing

17 - Feed line

- ☐ black
- ☐ clipped in place on the side of the fuel tank
- ☐ check for firm seating



18 - Return-flow line

- ☐ blue
- ☐ clipped in place on the side of the fuel tank
- ☐ check for firm seating

19 - Fuel tank lid unit

- ☐ with rubber bowl
- ☐ removing and installing ⇒ Body Work ⇒ Rep. gr. 55

Fitting position of flange of fuel delivery unit up to 05/2010

The marking -3- on the flange points against the direction of travel.

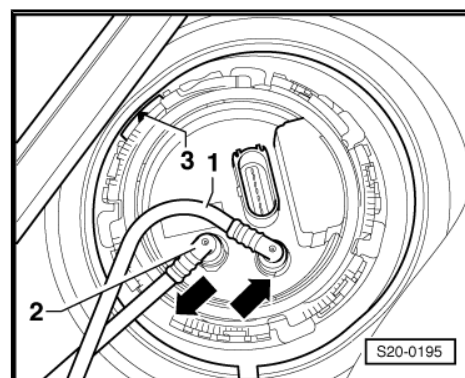


Note

The flange of the fuel delivery unit can only be installed in this position.

Blue or blue marked return-flow line -1-.

Black feed line -2-.



Note

After installing the flange of the fuel delivery unit, check whether the feed, return-flow and vent lines are clipped in place on the fuel tank.

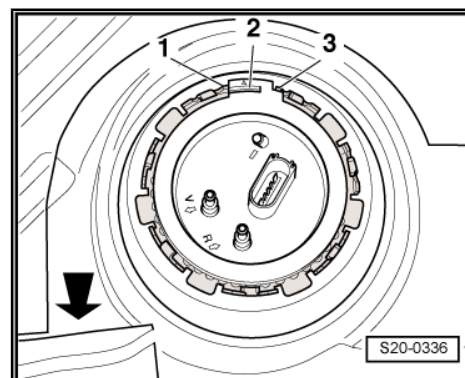
Fitting position of flange of fuel delivery unit as of 06/ 2010

The peg -2- on the fuel delivery unit must be between the pegs -1- and -3-.



Note

- ◆ *The -arrow- shows the direction of travel.*
- ◆ *The fuel delivery unit can only be installed in this position.*



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1.2 Fuel filter with component parts - Summary of components

1 - Fuel filter

- ☐ the direction of flow is marked by arrows
- ☐ do not interchange connections
- ☐ Fitting position: Pin at filter housing must engage in the recess of the guide at the filter holder
- ☐ as spare parts a gasket is an element of the fuel filter
- ☐ depending on the production date, delivered individually or complete with fuel pressure regulator

2 - Retaining clip

- ☐ for fuel pressure regulator

3 - Fuel feed line

- ☐ black
- ☐ from fuel tank
- ☐ to remove, press release button at connecting piece

4 - Fuel return-flow line

- ☐ blue
- ☐ to fuel tank
- ☐ to remove, press release button at connecting piece

5 - Fuel pressure regulator

- ☐ 0.4 MPa (4 bar)
- ☐ as spare parts a gasket is an element of the fuel pressure regulator
- ☐ depending on the production date, delivered individually or complete with fuel filter

6 - Gasket

- ☐ replace
- ☐ as spare parts it is an element of the fuel pressure regulator

7 - O-ring

- ☐ replace
- ☐ as spare parts it is an element of the fuel filter

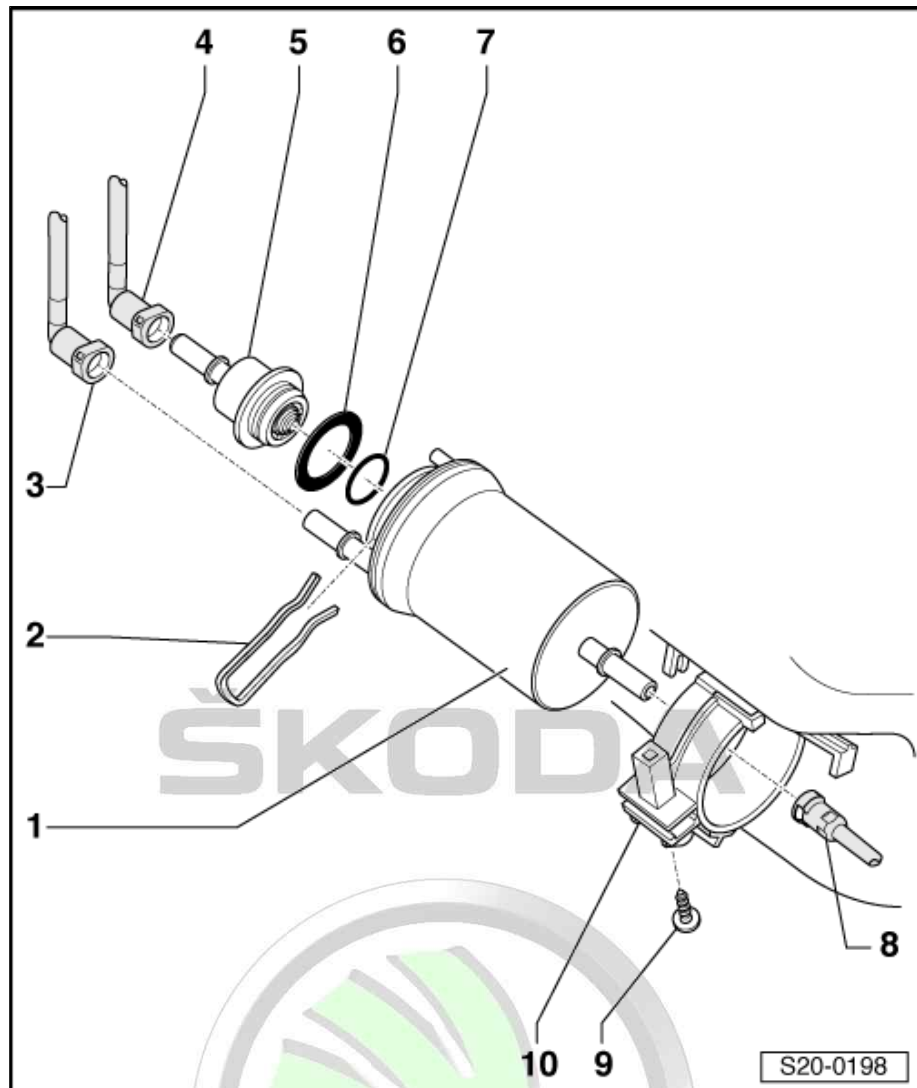
8 - Fuel feed line

- ☐ black
- ☐ to the engine
- ☐ to remove, press release button at connecting piece

9 - 3 Nm

10 - Support

- ☐ for fuel filter



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- ❑ attached to the fuel tank

1.3 Extract fuel from the fuel tank

Special tools and workshop equipment required

- ◆ Hose adapter , e.g. -V.A.G 1318/16 -
- ◆ Adapter , e.g. -V.A.G 1318/17A-
- ◆ Measuring tool set , e.g. -V.A.G 1594 C-
- ◆ Battery
- ◆ Fuel tank



Note

- ◆ *If the fuel pump is defective, suction off fuel using a fuel suction device , e.g. -VAS 5190- .*
- ◆ *Observe the safety instructions before starting fitting work
⇒ [page 2](#) .*
- ◆ *Observe rules for cleanliness ⇒ [page 2](#) .*

Work procedure

- Switch off ignition and all electrical loads, and pull out ignition key.
- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



Note

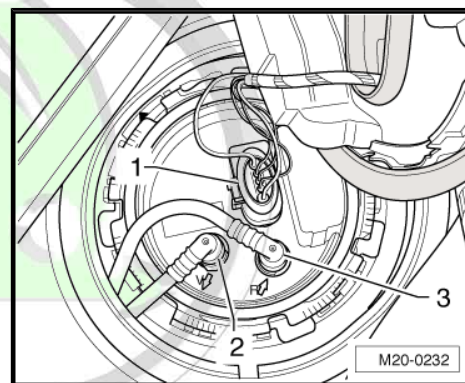
For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must also be separated.

- Unplug the 5-pin plug -1- from the black feed line -2-.



Note

Press in the securing ring in order to unlock the line.



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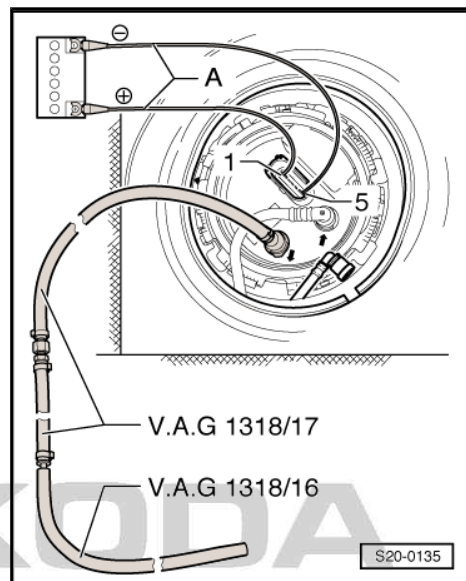
- Connect the adapter -V.A.G 1318/16- with the adapter -V.A.G 1318/17A- and fit this “drain pipe” thus prepared onto the feed support of the fuel delivery unit.
- Hold the “drain pipe” in a suitable fuel tank.
- Connect the battery and the contacts of the fuel pump with adapter cables -A- from the adapter cable set - V.A.G 1594/ C- as follows:
Battery positive terminal (+) to contact -1- of the fuel pump.
Battery negative terminal (-) to contact -5- of fuel pump.

The fuel pump runs and suctions off fuel.



WARNING

In order to prevent an overflow of fuel in case of a too small fuel tank, the fuel pump must not run unattended.



1.4 Removing and installing fuel delivery unit

Special tools and workshop equipment required

- ◆ Key - T30101 (3087)-

Removing

- The fuel tank must not be more than $\frac{1}{2}$ full.



Note

- ◆ If necessary, extract fuel from the fuel tank ⇒ [page 85](#).
- ◆ Observe the safety instructions before starting fitting work ⇒ [page 2](#).
- ◆ Observe rules for cleanliness ⇒ [page 2](#).

- Switch off ignition and all electrical loads, and pull out ignition key.
- Removing rear seat bench ⇒ Body Work; Rep. gr. 72.
- Remove the cover from the fuel delivery unit.



WARNING

The fuel feed line is pressurized! Place cleaning cloths around the connection point before detaching hose connections. Then reduce the pressure by carefully removing the hose.



Note

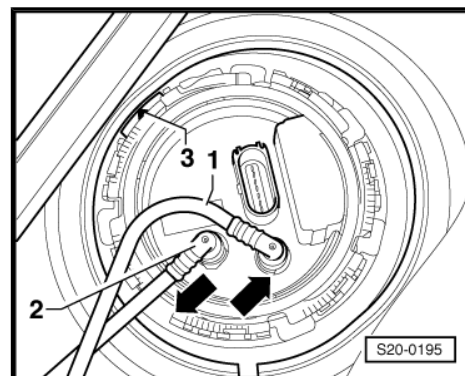
For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must also be separated.

- Unplug the 5-pin plug, the black feed line -2- and the blue return-flow line -1-.



Note

Press in the securing ring in order to unlock the fuel lines.

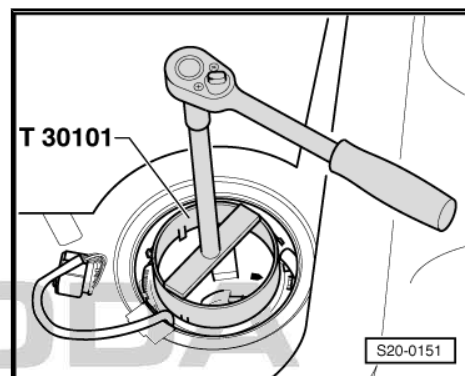


- Open lock ring with the wrench - T30101 (3087)- .
- Pull the fuel delivery unit and the gasket ring out of the opening of the fuel tank.



Note

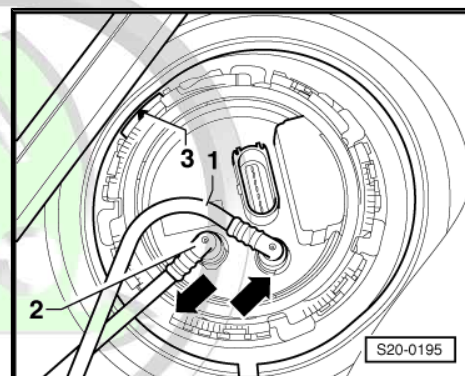
If fuel pump is to be renewed, old fuel pump must be drained before disposal.



Install

The fuel delivery unit is installed in the reverse order. Pay attention to the following:

Observe fitting position of flange of fuel delivery unit:



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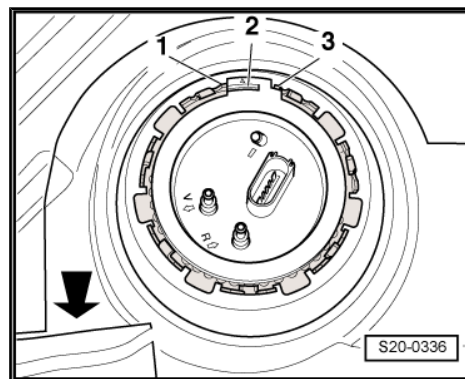


- ◆ On vehicles up to 05/2010, the marking on the flange -3- must point against the direction of travel. The flange of the fuel delivery unit can only be installed in this position.
- ◆ On vehicles as of 06/2010, the peg -2- on the fuel delivery unit must be positioned between the pegs -1- and -3-. The -arrow- shows the direction of travel. The flange of the fuel delivery unit can only be installed in this position.



Note

- ◆ When installing, ensure that the float arm of the sender for fuel gauge display - G- is not bent.
- ◆ Insert dry gasket ring of the fuel delivery unit into the opening of the fuel tank.
- ◆ Only moisten the gasket ring on the inside with fuel before assembly of the fuel delivery unit.
- ◆ Tighten the lock ring to 110 Nm.
- ◆ Do not interchange feed line and return-flow line.
- ◆ Make sure the line connections fit tightly.
- ◆ After installing the fuel delivery unit, check whether the feed, return-flow and vent lines are clipped in place on the fuel tank.



1.5 Removing and installing the sender for fuel gauge display - G-



Note

There are two types of senders for the fuel gauge display - G- installed in the vehicles.

Sender for fuel gauge display - G- type 1

Removing

- Remove fuel delivery unit ➔ [page 86](#) .
- Unlatch and disconnect the plug connection of the lines -1- (brown), -2- (blue) and -3- (black).
- Raise securing tabs -4- and -5- with a screwdriver and pull off the sender for fuel gauge display - G- towards the bottom -arrow-.

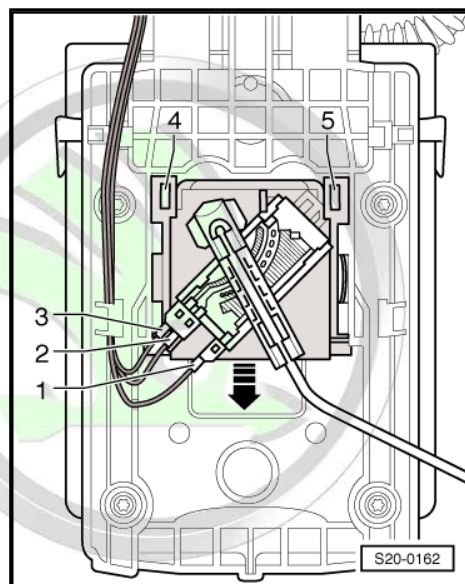
Install

- Insert the sender for the fuel gauge display - G- in the guides at the fuel delivery unit and press upwards until it latches into position.
- Connect the cables and check the plugs for secure catch.
- Install fuel delivery unit ➔ [page 85](#) .

Sender for fuel gauge display - G- type 2

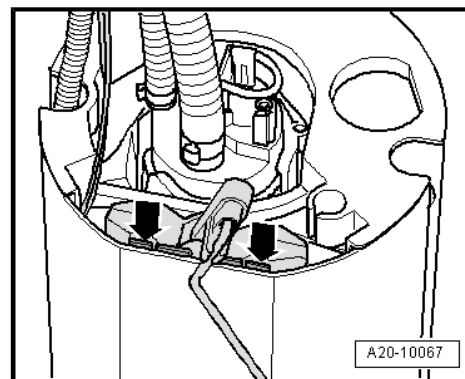
Removing

- Remove fuel delivery unit ➔ [page 85](#) .



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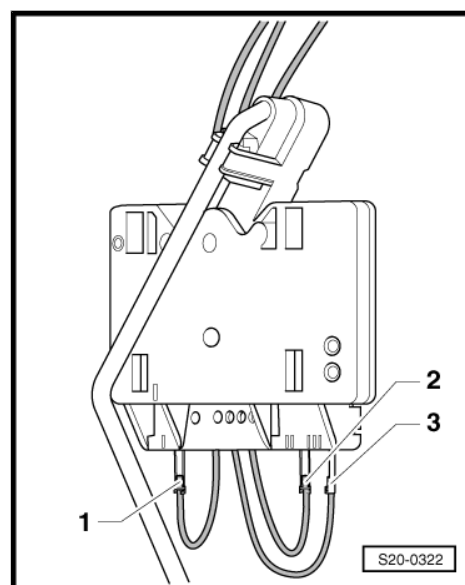
- Unlock the securing tabs -arrows- using a screwdriver and pull out the transmitter for fuel gauge display - G- towards the top.



- Unlatch and disconnect the plug connection of the lines -1- (brown), -2- (blue) and -3- (black).

Install

- Connect the cables and check the plugs for secure catch.
- Insert the sender for fuel gauge display - G- in the guides at the fuel delivery unit and press downwards until it latches into position.
- Install fuel delivery unit ➔ [page 85](#) .



1.6 Removing and installing the fuel tank

Special tools and workshop equipment required

- ◆ Engine and gearbox jack , e.g. -V.A.G 1383 A-

Removing

- The fuel tank must not be more than $\frac{1}{4}$ full.
- Ignition and all electrical components switched off, ignition key withdrawn.



Note

- ◆ Empty the fuel tank if necessary ➔ [page 85](#) .
- ◆ Observe the safety instructions before starting fitting work ➔ [page 2](#) .
- ◆ Observe rules for cleanliness ➔ [page 2](#) .

- Removing rear seat bench ➔ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.

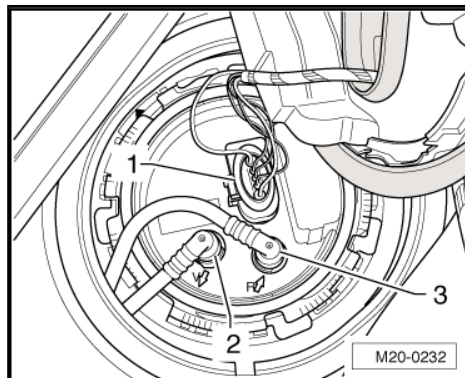
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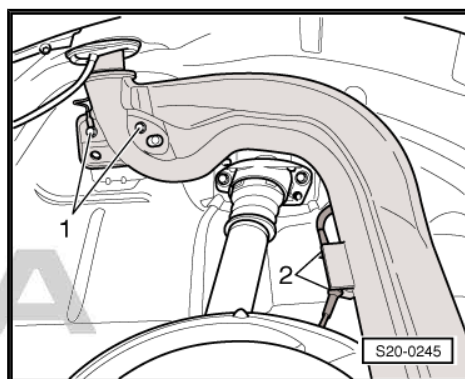
Note

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must also be separated.

- Unplug the 5-pin plug -1- from the fuel pump.
- Clean around the fuel filler neck.
- Unscrew right rear wheel.
- Remove the rear right wheelhouse liner ⇒ Body Work ⇒ Rep. gr. 66 .



- Unscrew screws -1- for filler neck on the body.
- Unclip the electrical cable from the bracket -2- at the top and bottom of the filler neck.

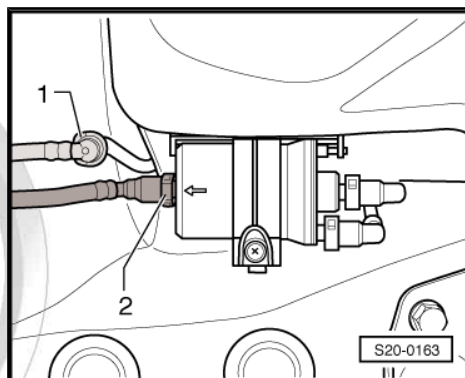


- Disconnect vent line -1- (white) and fuel feed line -2- (black) at the connection point.



Note

- ◆ *For vehicles with auxiliary heating, the fuel line for the dosing pump - V54- must be disconnected additionally.*
- ◆ *Press in the securing ring in order to unlock the line.*
- Remove middle part of exhaust system, if necessary first separate the middle and rear part of the exhaust system
⇒ [page 128](#) .

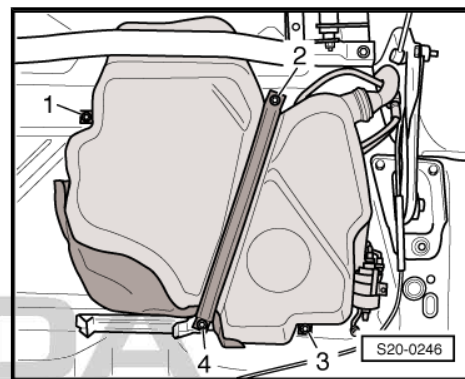


- Release fixing screws -2- and -4- and remove the tensioning strap.
- Support the fuel tank using the engine and gearbox jack - V.A.G 1383 A- .
- Release fixing screws -1- and -3-.
- Slightly lower the fuel tank.



Note

The filler neck must be "extracted" between body and rear axle. Lift fuel tank down from the engine and gearbox jack - V.A.G 1383 A- with a 2nd mechanic.

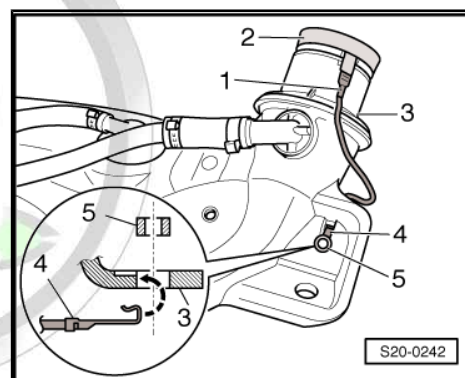


Install

- Check both earth connections for corrosion, if necessary remove corrosion.
- Check fitting position of the earth lead -1-.
- The plug -1- on the metal plate ring -2- must be placed on firmly.
- The contact tab -4- must be hung on the fuel tank -3- and secured with the spacer bush -5-.
- Guide the filler neck between rear axle and structure with the assistance of a 2nd mechanic. Then position the fuel tank onto the engine/gearbox jack - V.A.G 1383 A- .

Further installation occurs in reverse order. Pay attention to the following:

- ◆ Lay the vent and fuel lines without any kinks.
- ◆ Do not mix-up the feed line and the return-flow line (the return-flow line is blue, the feed line is black).
- ◆ Make sure the line connections and the 5-pin plug fit tightly.
- ◆ Check earth connection of fuel tank/body at filler neck.
- ◆ After installing the fuel tank, check whether the lines are also clipped in place on the fuel tank.



1.7 Testing fuel pump

Special tools and workshop equipment required

- ◆ Wrench for union nut - T30101 (3087)-
- ◆ Pressure gauge , e.g. -V.A.G 1318-
- ◆ Adapter , e.g. -V.A.G 1318/11-
- ◆ Adapter , e.g. -V.A.G 1318/1-
- ◆ Adapter , e.g. -V.A.G 1318/17-
- ◆ Remote control , e.g. - V.A.G 1348/3A-
- ◆ Measuring tool set , e.g. -V.A.G 1594 A, B oder C-
- ◆ Test instrument adapter/DSO (5-pin) , e.g. -VAS 5565-
- ◆ Hand multimeter , e.g. -V.A.G 1715-
- ◆ Measuring vessel

**Note**

- ♦ *Observe the safety instructions before starting fitting work*
⇒ [page 2](#) .
- ♦ *Observe rules for cleanliness ⇒ [page 2](#) .*

1.7.1 Checking the function and supply voltage

Test conditions

- Battery voltage at least 11.5 V.
- Fuel pump relay - J17 - O.K.
- Fuel pump fuse O.K. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Work procedure**Note**

The function of the fuel pump is tested with the actuator diagnosis.

- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Connect ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- On the display tip consecutively the buttons for “Vehicle self-diagnosis”, “01 - Engine electronics” and “03 - Actuator diagnosis”.
- On the display, press the right arrow key to activate the pressure pump relay - J17- .
- The fuel pump must be pulsed for **start-up**.

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**Note**

The fuel pump runs very quietly.

- Switch off ignition.

If the fuel pump does not run:

- Remove the cover from the fuel delivery unit.

**Note**

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must be disconnected additionally.

- First of all check the plug -arrow- for correct fit. To do so, pull on the plug without pressing the catch.

If the plug was not correctly plugged in:

- Repeat the functional test of the fuel pump.

If the plug was correctly plugged in:

- Disconnect the plug -arrow- from the fuel delivery unit.
- Check contacts on plug and on fuel pump for damage.

If no damage was detected:

- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the handheld multimeter - V.A.G 1715- to the terminals -1 and 5- of the adapter for measuring method/DSO (5-pin) - VAS 5565- .
- Once again initiate the “03 - Actuator diagnosis” and actuate the fuel pump relay - J17- , the voltage must be pulsed in order to increase.

Supply voltage not O.K.:

- Determine and remove open circuit in the wiring according to the current flow diagram ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Supply voltage O.K.:

- Remove fuel delivery unit ⇒ [page 86](#) .
- Check that electrical wires between flange and fuel pump are connected.

If there is no open circuit in the wiring:

- Fuel pump defective, replace fuel delivery unit ⇒ [page 86](#) .

1.7.2 Check fuel flow rate

Test conditions

- Supply voltage o.k.
- Fuel pressure regulator and holding pressure o.k.

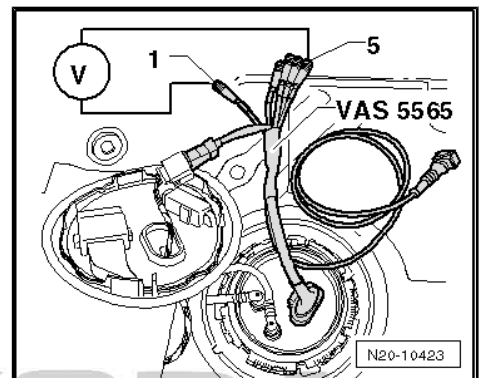
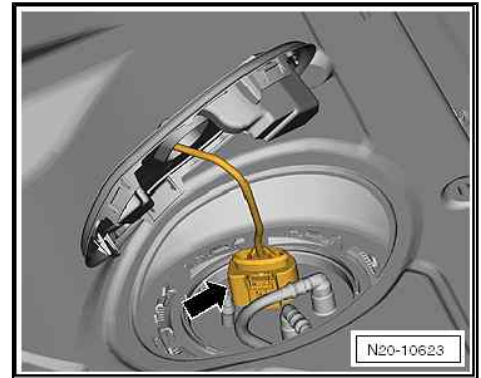
Work procedure

- Switch off ignition and all electrical loads, and pull out ignition key.
- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



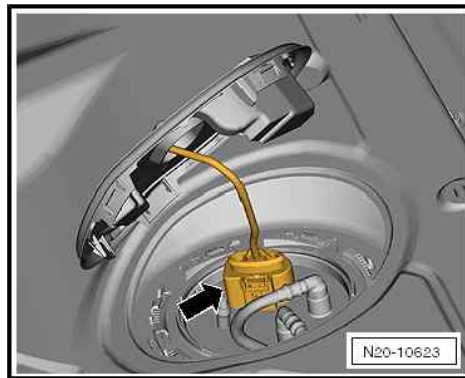
Note

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must be disconnected additionally.





- First of all check the plug -arrow- for correct fit. To do so, pull on the plug without pressing the catch. If the plug was not correctly plugged in, it may have caused a fault.
- Disconnect the plug -arrow- from the fuel delivery unit.
- Check contacts on plug and on fuel pump for damage.



- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the remote control - V.A.G 1348/3A- to the adapter - VAS 5565- and to the battery positive (+).



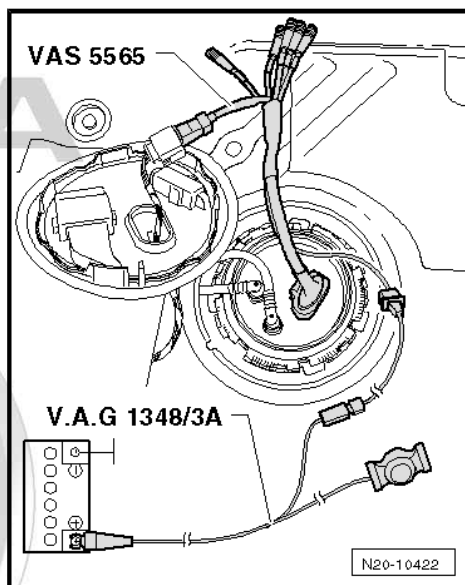
Note

- ♦ *This step is only intended to ensure that the fuel delivery unit runs when the engine is switched off.*
- ♦ *The fuel flow rate of the fuel delivery unit is measured at 0.4 MPa (4 bar). Therefore the fuel pressure must be checked before measuring the fuel flow rate.*



WARNING

The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.



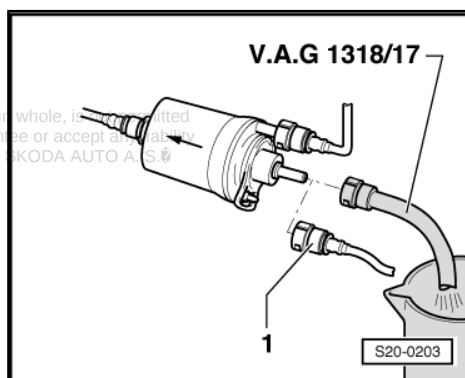
- Detach return-flow line -1- from fuel pressure regulator.



Note

Press in the securing ring in order to unlock the fuel line.

- Connect adapter -V.A.G 1318/17- at fuel pressure regulator and hold the end of the adapter in a measuring vessel.
- Operate remote control -V.A.G 1348/3A- for about 5 seconds, in order to fill up the fuel filter.
- Drain the measuring vessel.
- The fuel flow rate of the fuel delivery unit is dependent on the voltage. Therefore, connect the handheld multimeter - V.A.G 1715- to the terminals -1 and 5- of the adapter for measuring method/DSO (5-pin) - VAS 5565- .
- Activate remote control for 30 seconds while measuring the battery voltage.



- Compare the fuel rate with the specified value.

*) Minimum fuel flow rate in $\text{cm}^3/30 \text{ s}$

***) Voltage at fuel delivery unit when engine not running and delivery unit operating.

Read out examples:

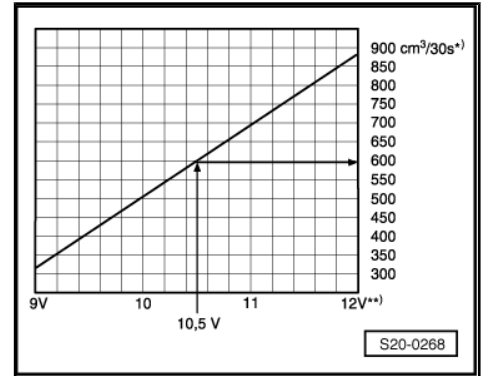
During the test a voltage of 10.5 V was measured. Thus a minimum fuel flow rate of 580 $\text{cm}^3/30 \text{ s}$ is obtained.

If the minimum fuel delivery volume is not reached:

- Check the feed line to the filter for possible restrictions (kinks) or blocking.

If the fuel line is O.K.:

- Check the fuel flow rate before the fuel filter.



WARNING

The fuel feed line is pressurized! Place cleaning cloths around the connection point before detaching hose connections. Reduce pressure by carefully removing the hose.

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- Disconnect the feed line -1- from the fuel filter inlet.



Note

Press in the securing ring in order to unlock the fuel line.

- Connect pressure gauge -V.A.G 1318- with adapter set -V.A.G 1318/17- as shown.
- Fit adapter -V.A.G 1318/1- onto adapter -V.A.G 1318/11- of pressure gauge and hold in a measuring vessel.
- Open shut-off cock of the pressure gauge. The lever then points in the direction of flow -A-.
- Activate remote control -V.A.G 1348/3A- . While doing so, slowly close the shut-off cock until the pressure gauge displays 0.4 MPa (4 bar) overpressure. Do not make any further changes to the position of the shut-off cock.
- Drain the measuring vessel.
- Activate remote control again for 30 seconds. Compare the fuel flow rate with the value determined during the first measurement.

If the minimum fuel flow rate is now reached

- Replace fuel filter.

If the minimum fuel flow rate is again not reached:

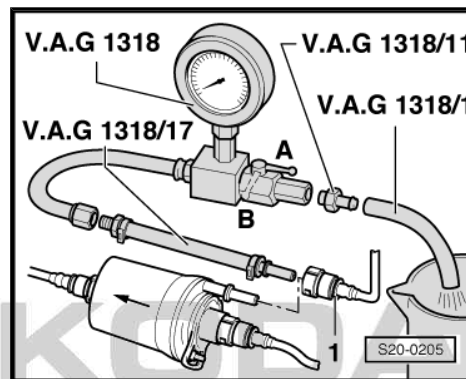
- Remove fuel delivery unit and inspect filter strainer for soiling.

Only if no fault has yet been detected:

- Replace fuel delivery unit.
- Connect all released fuel lines.
- Venting air from the fuel system ➔ [page 101](#) .

If the required fuel delivery volume has been achieved, but a fault is still suspected in the fuel supply system (e.g. intermittent breakdown of the fuel supply):

- Check current consumption of fuel delivery unit ➔ [page 96](#) .



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1.7.3 Check power consumption

- Removing rear seat bench ➔ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



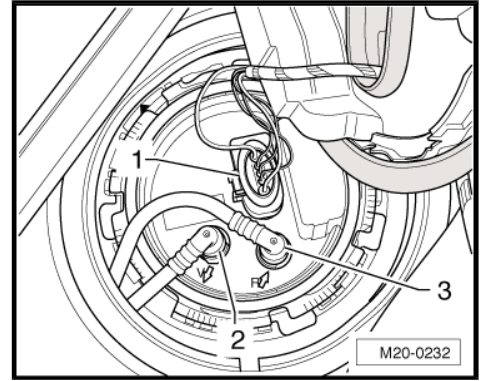
Note

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must be disconnected additionally.

- First of all check the plug -1- for correct fit. To do so, pull on the plug without pressing the catch. If the plug was not correctly plugged in, it may have caused a fault.
- Now unplug the plug -1-.
- Check contacts on plug and on fuel pump for damage.

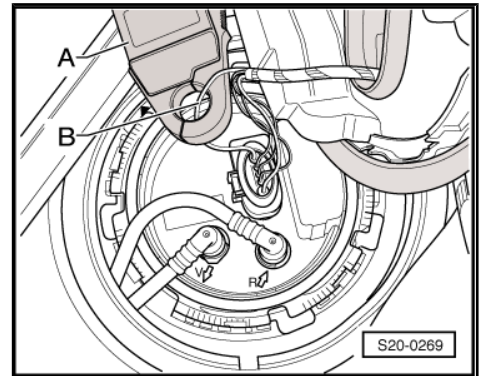
If no damage was detected:

- Fit again plug -1-.



- Connect the current probe -A- of the vehicle diagnosis, measurement and information system - VAS 505X- on the line -B- to contact 1 of the 5-pin plug.

If the current probe cannot be connected on the line -B- to contact 1 of the 5-pin plug because of the length of the insulation:

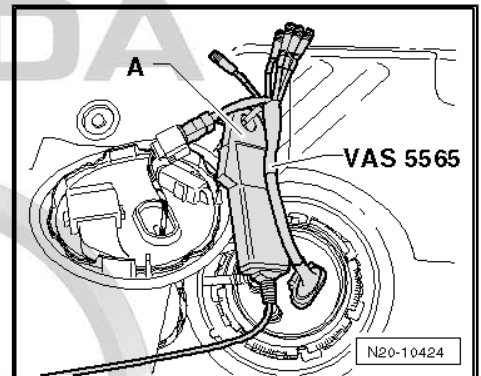


- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the current probe -A- to the red cable - with the lettering "current probe" - of the adapter for measuring method/ DSO (5-pin) - VAS 5565- .

Continued for all

- Start engine and run in idle.
- Measure voltage consumption of the fuel pump.

Specified value: max. 9 A



Note

If the fault in the fuel supply system is intermittent then tests can be undertaken during a test drive but then two people are required for this.

If the specified current uptake is exceeded:

- Fuel pump defective, replace fuel delivery unit ⇒ [page 85](#) .

1.7.4 Checking the non-return valve on the fuel pump

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- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.

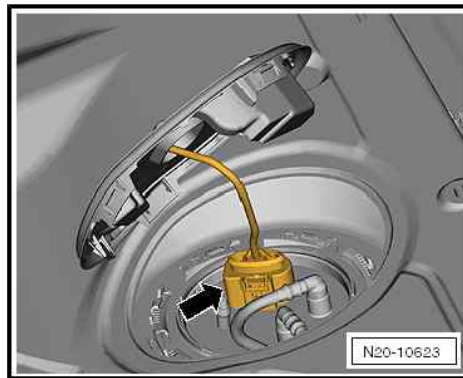


Note

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must be disconnected additionally.



- First of all check the plug -arrow- for correct fit. To do so, pull on the plug without pressing the catch. If the plug was not correctly plugged in, it may have caused a fault.
- Disconnect the plug -arrow- from the fuel delivery unit.
- Check contacts on plug and on fuel pump for damage.

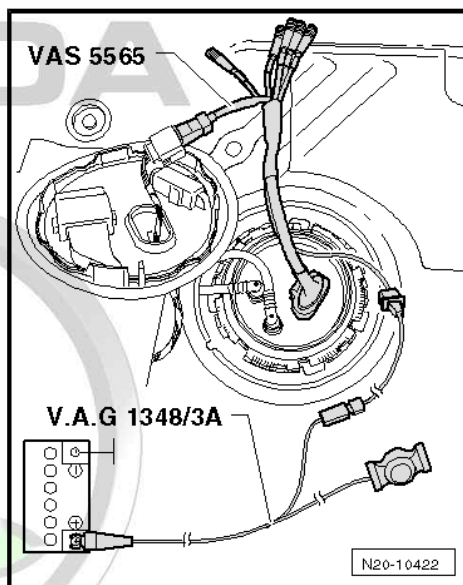


- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the remote control - V.A.G 1348/3A- to the adapter - VAS 5565- and to the battery positive (+).



WARNING

The fuel feed line is pressurized! Place cleaning cloths around the connection point before detaching hose connections. Reduce pressure by carefully removing the hose.



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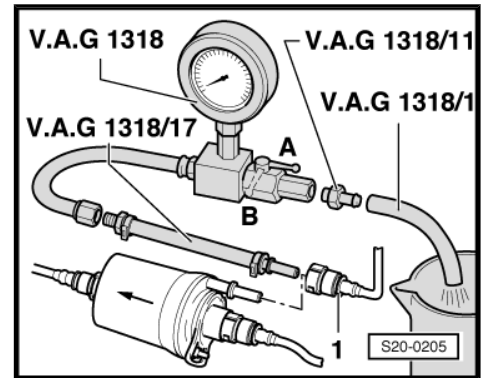
- Disconnect the feed line -1- from the fuel filter inlet.



Note

Press in the securing ring in order to unlock the fuel line.

- Connect pressure gauge with adapter set -V.A.G 1318/17- as shown.
- Fit adapter -V.A.G 1318/1- onto adapter -V.A.G 1318/11- of pressure gauge and hold in a measuring vessel.
- Close the shut-off cock of the pressure gauge -V.A.G 1318- (set the lever at right angles to the direction of flow of fuel -B-).
- Activate the remote control with short pauses in between until an overpressure of 0.4 MPa (4 bar) is built up.



WARNING

Danger of liquid spraying out when opening the shut-off cock; hold the container in front of the free connection to the pressure gauge.

- Lower an overpressure which has become too high by carefully opening the shut-off valve.
- Observe pressure drop at pressure gauge. The pressure must not drop below 0.3 MPa (3 bar) after 10 minutes.

If the pressure still drops:

- Check line connections for leaktightness.

If the lines are not found to be faulty:

- Fuel pump defective, replace fuel delivery unit ➔ [page 85](#) .

1.8 Test fuel pressure regulator and holding pressure

Special tools and workshop equipment required

- ◆ Pressure gauge, e.g. - V.A.G 1318-
- ◆ Adapter, e.g. - V.A.G 1318/9-
- ◆ Adapter set, e.g. - V.A.G 1318/17-
- ◆ Double connection piece - V.A.G 1318/23-
- ◆ Remote control, e.g. - V.A.G 1348/3 A-



Note

- ◆ *The fuel pressure regulator regulates the fuel pressure to approx 0.4 MPa (4 bar).*
- ◆ *The fuel pressure regulator is located on the fuel tank.*
- ◆ *Observe safety measures ➔ [page 2](#) .*
- ◆ *Observe rules for cleanliness ➔ [page 2](#) .*

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**WARNING**

The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.

- Separate the connector of the fuel feed line -3- and collect the fuel with flows out with a cloth.

**Note**

Press together the securing ring in order to unlock the fuel line.

- Connect pressure gauge, e.g. - V.A.G 1318- with adapter, e.g. - V.A.G 1318/9- and with adapter set, e.g. - V.A.G 1318/17- to fuel filter -1- and to fuel feed line -2-.
- Open shut-off cock of the pressure gauge. Lever points in direction of flow.
- Venting air from the fuel system ➔ [page 101](#).
- Start engine and run in idle.
- Measure fuel pressure. Specified value: approx. 0.4 MPa (4.0 bar) overpressure.

If the specified value is not reached:

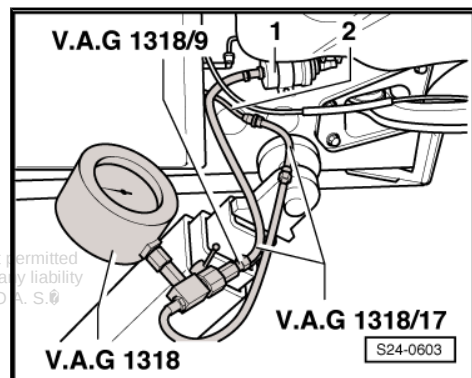
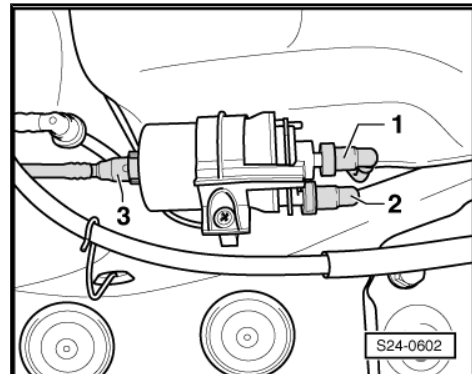
- Switch off ignition.
- Check the fuel flow rate of the fuel pump ➔ [page 93](#).
- If the fuel delivery unit is o.k., replace the fuel pressure regulator ➔ [page 84](#).

If the specified value is reached:

- Switch off ignition.
- Check for tightness and holding pressure (complete system). To this end observe the pressure drop on the pressure gauge. After 10 minutes there must still be at least 0.3 MPa (3.0 bar) present.

If the holding pressure drops below 0.3 MPa (3 bar):

- Start engine and run in idle.



- After the pressure has built up, switch ignition off. At the same time close the shut-off cock of the pressure gauge (lever at right angles to direction of flow) -arrow-.

- Observe pressure drop (engine side) on pressure gauge.

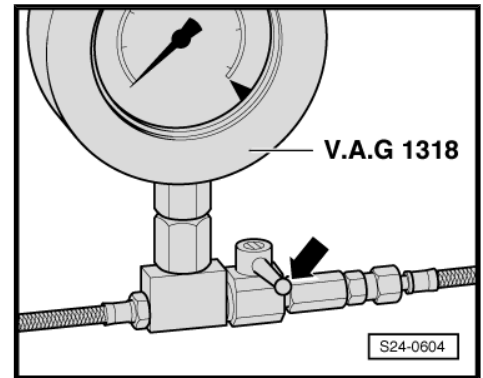
If the pressure drops again:

- Check the line connections, the O-rings on the fuel rail and the injection valves for tightness.
- Inspect pressure measuring device for leaks.



Note

Place a cleaning cloth around the connection point prior to removal of the pressure measuring device.



If the pressure does not drop:

- Check the line connections to the fuel tank and the non-return valve of the fuel delivery unit.
- If the non-return valve is o.k., replace the fuel pressure regulator ⇒ [page 84](#) .
- Venting air from the fuel system ⇒ [page 101](#) .

1.9 Venting air from the fuel system



Note

- ◆ *In order to avoid damage to the catalyst, the fuel system without return-flow line must be bled after working on the fuel lines or at the fuel filter. The vehicle can only be started after bleeding.*
- ◆ *Observe the safety instructions before starting fitting work* ⇒ [page 2](#) .
- ◆ *Observe rules for cleanliness* ⇒ [page 2](#) .

Special tools and workshop equipment required

- ◆ Remote control - V.A.G 1348/3 A-
- ◆ Test instrument adapter/DSO (5-pin) , e.g. -VAS 5565-
- ◆ Adapter - V.A.G 1318/20-
- ◆ Adapter - V.A.G 1318/20-1-



WARNING

- ◆ ***The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.***

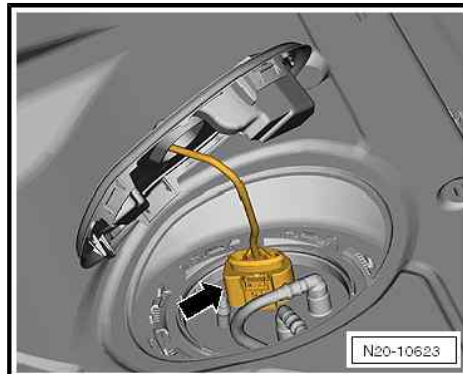
- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



Note

For vehicles with auxiliary heating, the plug connection for the dosing pump - V54- must be disconnected additionally.

- Disconnect the plug -arrow- from the fuel delivery unit.
- Check contacts on plug and on fuel pump for damage.



- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the remote control - V.A.G 1348/3A- to the adapter - VAS 5565- and to the battery positive (+).

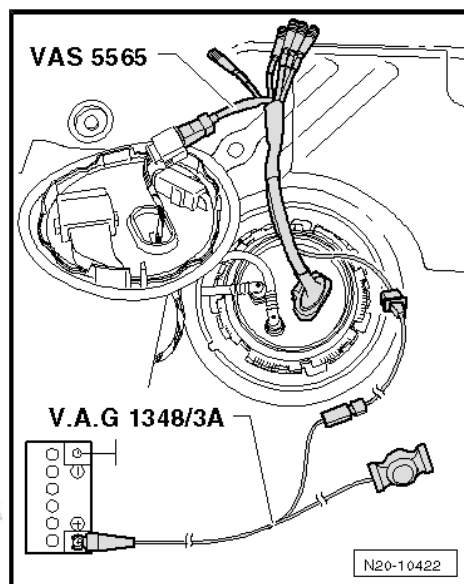
For engine with identification characters BCA

- Remove engine cover with air filter ➔ [page 114](#) .

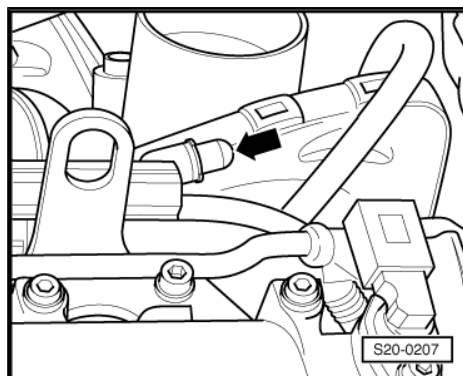
For engines with identification characters BUD, CGGA

- Remove the air filter housing ➔ [page 115](#) .

Continued for all vehicles



- Remove the ventilation valve cap -arrow- on the fuel strip.



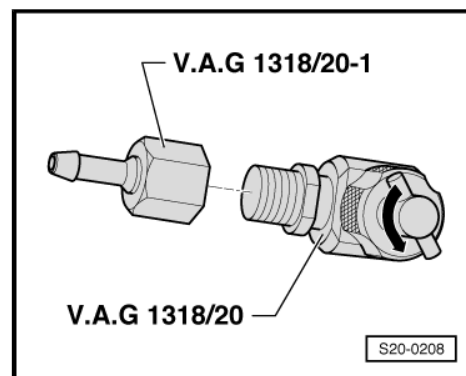
- Screw adapter - V.A.G 1318/20-1- onto adapter - V.A.G 1318/20- .
- Turn the valve (at T-union) anti-clockwise, until it is fully opened.
- Screw adapter - V.A.G 1318/20- fully onto the vent valve.
- Connect hose with catch pan to adapter - V.A.G 1318/20-1- .
- Screw valve (at T-union) clockwise up to the stop into the vent valve.
- Check the adapter and hose connections for leaktightness.
- Activate remote control -V.A.G 1348/3A- .
- As soon as fuel flows out of the hose without bubbles, unscrew valve (at T-piece) anti-clockwise, until no more fuel escapes.
- Cover ventilation valve with a clean cloth.
- Throttle the bleeder hose and pull off from adapter - V.A.G 1318/20-1- .
- Unscrew adapter - V.A.G 1318/20- from vent valve.
- Screw in ventilation valve cap.

For engine with identification characters BCA

- Install engine cover with air filter ➔ [page 114](#) .

For engines with identification characters BUD, CGGA

- Install air filter housing ➔ [page 115](#) .



2 Electronic Engine Power Control (Electronic throttle)

2.1 Assembly overview - accelerator module

1 - Connector

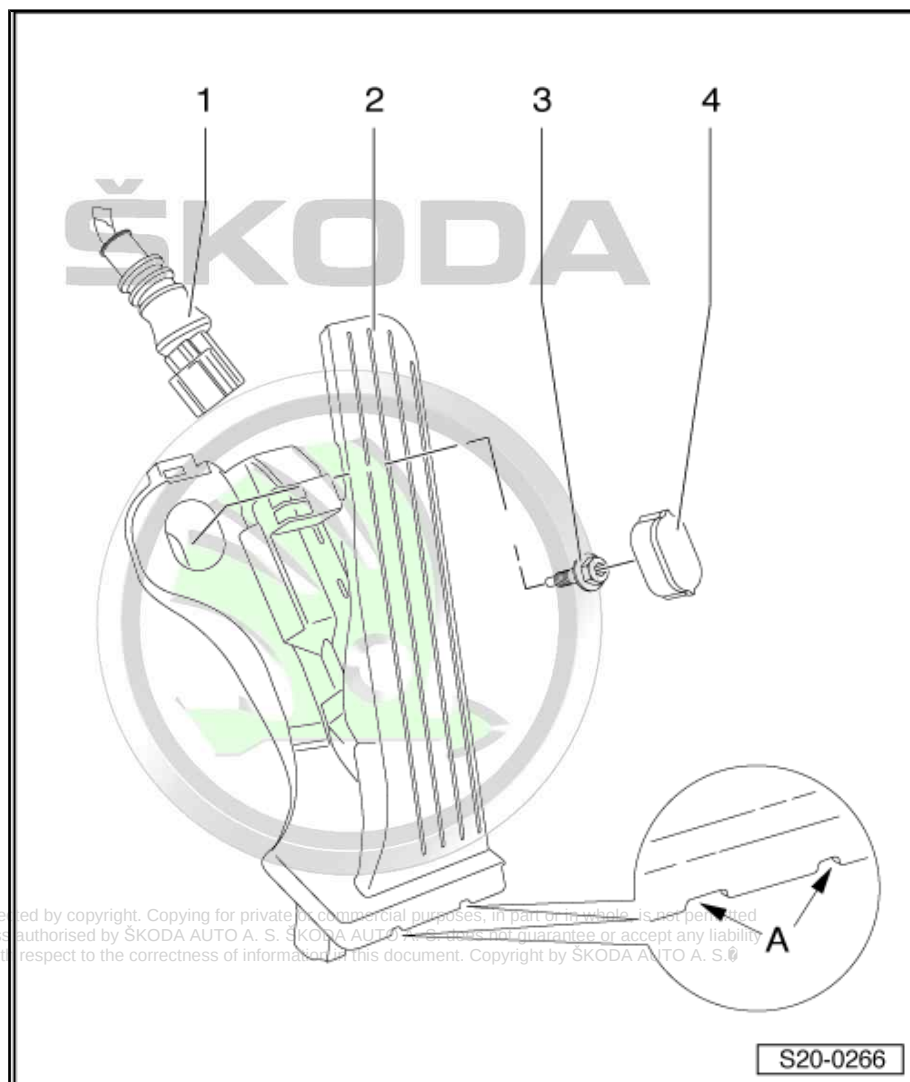
- ☐ black, 6 pin
- ☐ disconnect and fit on
 ⇒ [page 106](#)

2 - Accelerator pedal module

- ☐ with accelerator pedal position sender - G79- and accelerator pedal position sender 2 - G185-
- ☐ not adjustable
- ☐ -A- are openings for the release tool
- ☐ removing and installing
 ⇒ [page 104](#)

3 - 10 Nm

4 - Cover



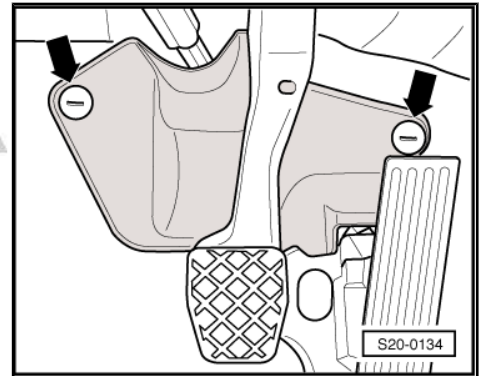
2.2 Removing and installing accelerator pedal module

Special tools and workshop equipment required

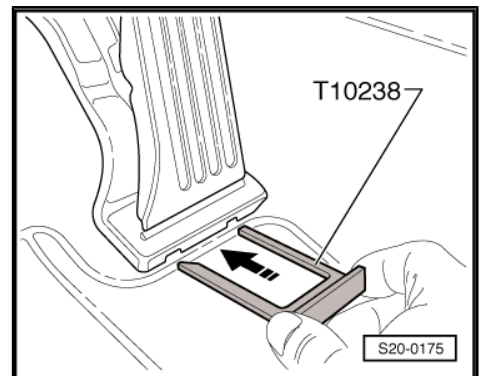
- ◆ Release tool - T10238- (for left-hand drive vehicle)
- ◆ Release tool - T10240- (for right-hand drive vehicle)

Removing

- Remove steering column trim panel -arrows-.
- Lever out the cap (➤ [page 104](#) Pos. 4) with a screwdriver.
- Release fixing screw (➤ [page 104](#) Pos. 3).

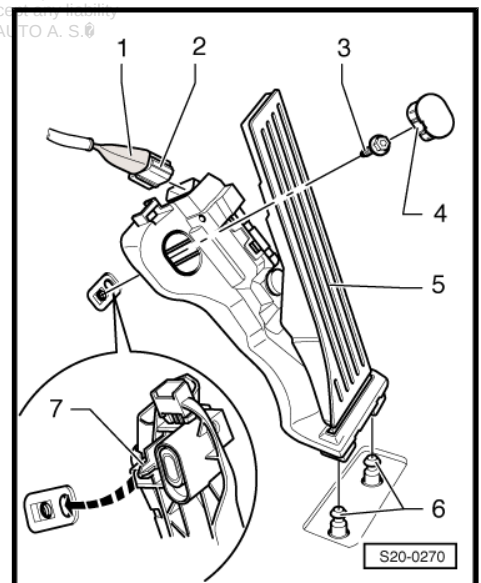


- Push the release tool - T10238 - (for right-hand drive vehicles release tool - T10240 -) as shown up to the stop into the provided openings and remove the accelerator pedal module.
- Disconnect connector at accelerator pedal module ➤ [page 106](#) .



Install

- Fit the plug -2- onto the accelerator pedal module -5- ➤ [page 106](#) .
- Push accelerator pedal module onto the retaining bolts -6-.
- Insert the centering pin -7- into the hole on the underbody.
- Fasten accelerator pedal module with screw -3- (10 Nm) and fit on cap -4-.
- Re-install steering column trim panel.



2.2.1 Disconnect connector for accelerator pedal module and fit on



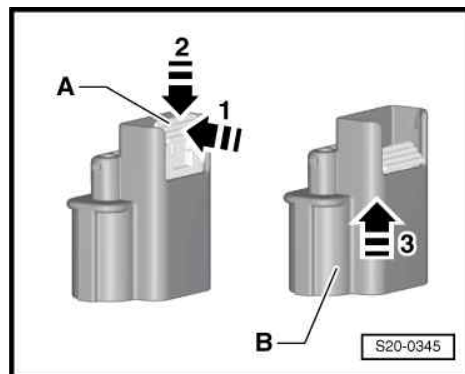
Note

The plugs for the accelerator pedal module which are inserted, must be disconnected and fit on in a different manner.

Disconnect connector 1K0 973 706

- Slightly press the piston slide valve -A- (grey) in -direction of arrow 1- and push it up to the stop in -direction of arrow 2-.
- Hold the piston slide valve in this position and disconnect the socket housing -B- towards the top in -direction of arrow 3-.

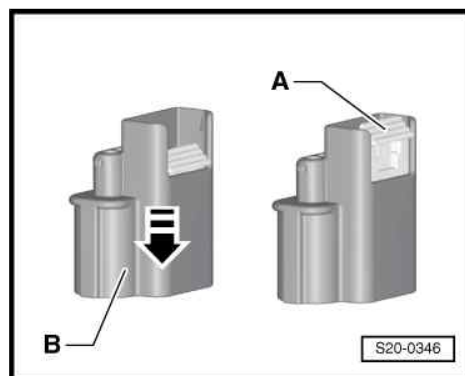
The piston slide valve -A- remains in the bottom position.



Fit on connector 1K0 973 706

- Push the socket housing -B- down in -direction of arrow- until the housing can be heard to lock in place.
- For safety reasons, check the connector for secure catch by tightening it in the opposite direction.

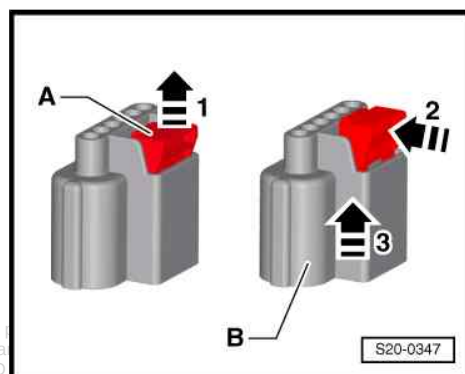
The piston slide valve -A- moves automatically upwards.



Disconnect connector 8K0 973 706

- Pull the piston slide valve -A- (red) upwards in -direction of arrow 1- up to the stop.
- Press the piston slide valve in -direction of arrow 2- and disconnect the socket housing -B- upwards in -direction of arrow 3-.

The piston slide valve -A- remains in the top position.

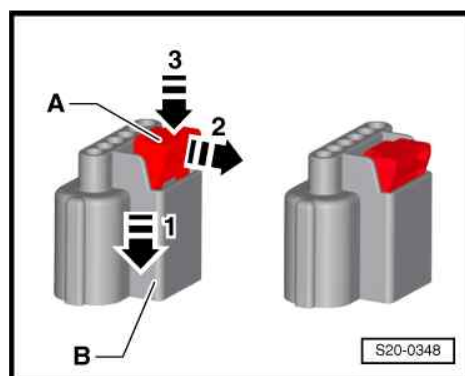


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Fit on connector 8K0 973 706

- Push the socket housing -B- downwards up to the stop in -direction of arrow 1-.
- Slightly press the piston slide valve in -direction of arrow 2- and push it downwards in -direction of arrow 3-.
- For safety reasons, check the connector for secure catch by tightening it in the opposite direction.

The piston slide valve -A- can only be pushed downwards if the socket housing was pushed downwards »up to the stop«.



3 Activated charcoal container system

3.1 Assembly overview - activated charcoal filter system



Note

- ◆ The hose connections are secured with spring strap clips or clamp-type clips.
- ◆ Always replace clamp-type clips with spring-type clips.
- ◆ Use pliers for spring strap clips to fit the spring strap clips.

Observe safety measures ➔ [page 2](#) .

Observe rules for cleanliness ➔ [page 2](#) .

1 - Activated charcoal filter

- ☐ Location: in right of engine compartment
- ☐ Checking the fuel tank venting ➔ [page 108](#)

2 - Pressure holding valve with connection hose

3 - Connecting hose

- ☐ check for firm seating
- ☐ from fuel tank

4 - 10 Nm

5 - Solenoid valve 1 - N80-

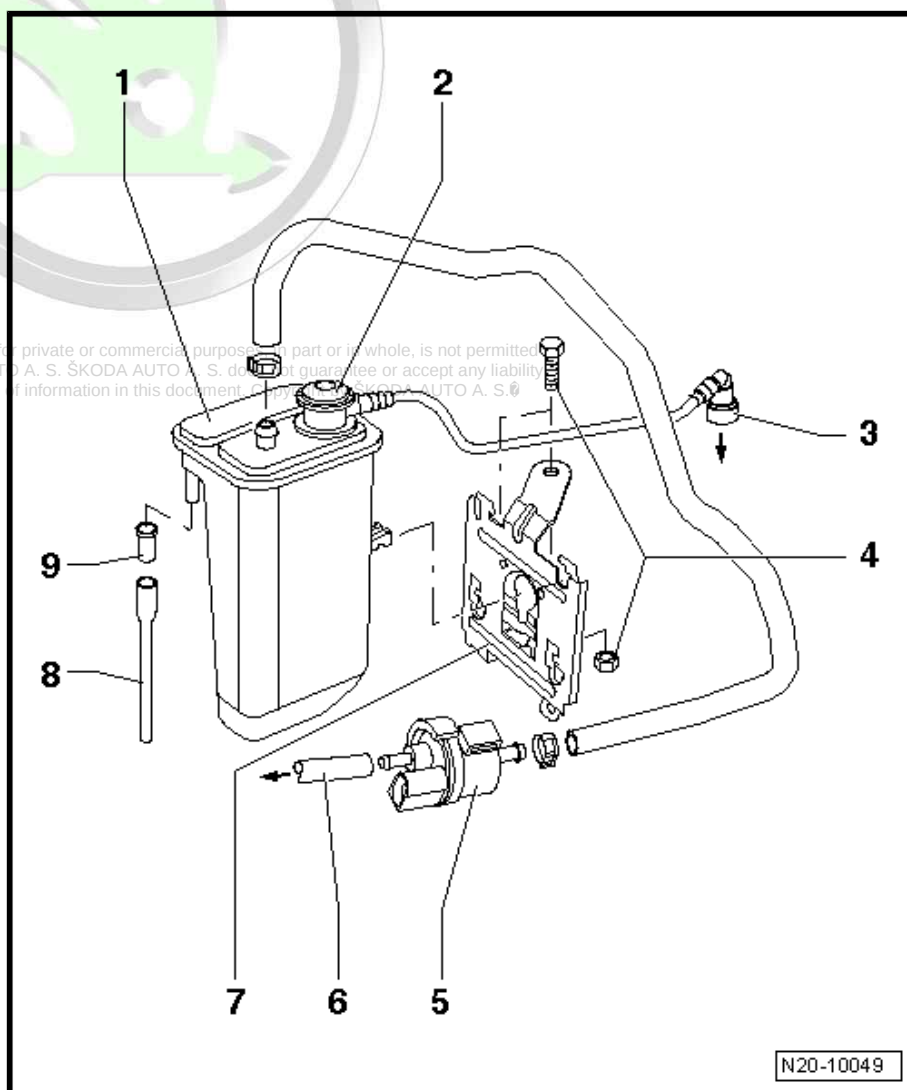
- ☐ When the ignition is switched off, the valve is closed
- ☐ When the engine has reached its operating temperature, the valve is actuated by the engine control unit (pulsed)
- ☐ attached in the bracket at the top of the intake manifold
- ☐ for removing, first on engine with identification characters:
- ◆ BCA - remove engine cover with air filter ➔ [page 114](#)
- ◆ BUD, CGGA - remove air filter housing ➔ [page 115](#)

6 - Connecting hose

- ☐ To intake manifold
- ☐ check for firm seating

7 - Support

- ☐ for activated charcoal filter





8 - Breather hose

- ☐ mounted up to 10/2004

9 - Sealing grommet

- ☐ mounted up to 10/2004

3.2 Checking the fuel tank venting

Special tools and workshop equipment required

- ◆ Hand vacuum pump , e.g. -VAS 6213-
- ◆ Adapter set , e.g. - V.A.G 1318/17A-
- ◆ Adapter , e.g. -V.A.G 1318/20-1-



Note

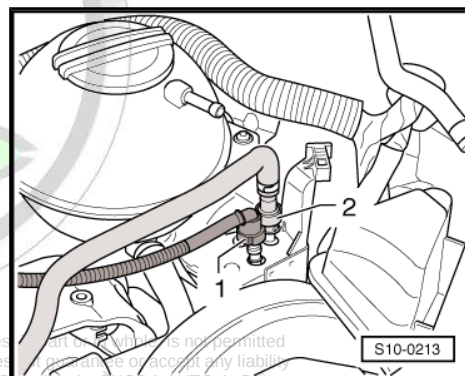
- ◆ *The adapter set - V.A.G 1318/17A- replaces the adapter set - V.A.G 1318/17 - .*
- ◆ *The figures shown in the description were not changed for this reason.*

Test condition

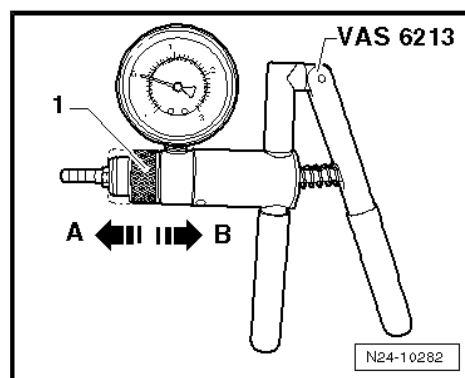
- The ignition must be switched off.

Test sequence

- Detach vent line -1-. To do so press in the securing ring.



- Put the control ring -1- of the hand vacuum pump - VAS 6213- in position -A- for "pressure".



- Then connect the hand vacuum pump - VAS 6213- -1- on the vent line -2- as shown in the figure.
- Operate the hand vacuum pump - VAS 6213- several times.
- No vacuum should build up.

If a vacuum builds up:

- Check the air admission fitting on the activated charcoal filter for dirt and clean as required.

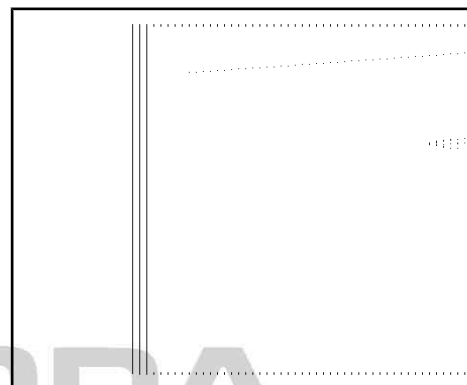
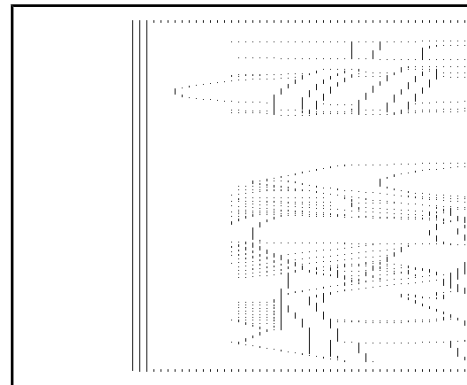
If no vacuum builds up:

- Shut off air admission fitting -arrow- and once again operate the hand vacuum pump several times.

- A vacuum should build up.

If no vacuum builds up:

- Replace activated charcoal filter.



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24 – Mixture preparation - injection

1 Fuel Injection System

1.1 Overview of the fitting locations of the injection and ignition system

1 - The vacuum regulating valve (PCV valve)

- ☐ for crankcase ventilation

2 - Heating resistor for crankcase ventilation -N79-

- ☐ for engine identification characters BCA
- ☐ for engine identification characters BUD up to 03/2009

3 - Engine control unit -J220-

- ☐ Location: in plenum chamber

4 - Activated charcoal filter system solenoid valve 1 -N80-

- ☐ removing and installing
⇒ [page 107](#)

5 - Intake manifold

6 - Intake manifold pressure sender -G71- with intake manifold temperature sender -G72-

7 - Injector -N30...N33-

8 - Knock sensor 1 -G61-

- ☐ Location: Cylinder block suction side
- ☐ removing and installing
⇒ [page 132](#)

9 - Throttle valve control unit -J338-

10 - Engine speed sender -G28-

- ☐ inductive pickup
- ☐ Location: Cylinder block suction side ⇒ [page 26](#)

11 - 6-pin plug

- ☐ for lambda probe and lambda probe heating before catalyst

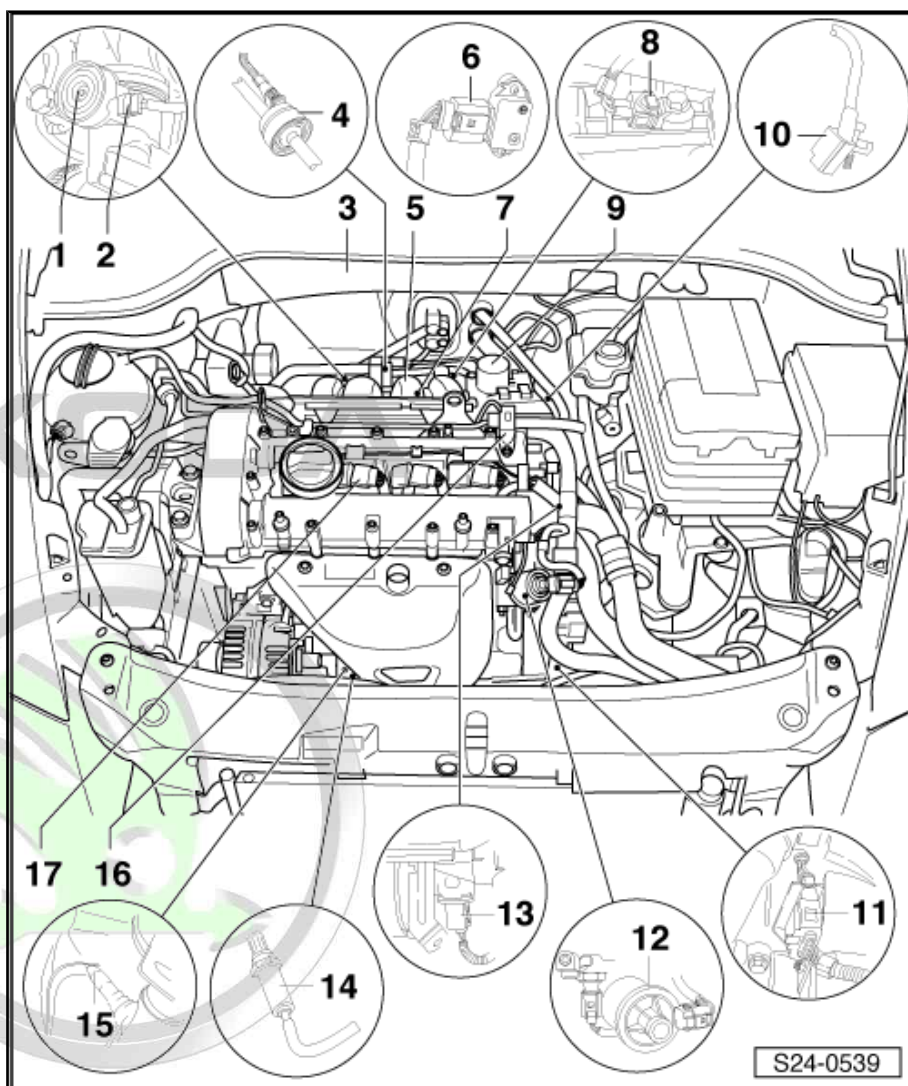
12 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

- ☐ removing and installing ⇒ [page 131](#)
- ☐ for engine identification characters BCA up to 05/2005

13 - Coolant temperature sender -G62-

14 - Lambda probe upstream of catalytic converter -G39- , 50 Nm

- ☐ Location: at pre-catalytic converter



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15 - Lambda probe downstream of catalytic converter -G130- , 50 Nm

- ☐ Location: downstream of catalytic converter

16 - Hall sender -G40-

- ☐ removing and installing ⇒ [page 132](#)

17 - Ignition coils with a power output stage -N70, N127, N291 a N292-

- ☐ removing and installing ⇒ [page 132](#)

1.2 Intake manifold - Summary of components (for engine identification characters BCA)

1 - Dipstick

2 - 20 Nm

3 - Fuel rail with injection valves

- ☐ Summary of components ⇒ [page 113](#)

4 - Throttle valve control unit - J338-

- ☐ when replacing, adapt the engine control unit
⇒ Vehicle diagnostic tester
- ☐ Cleaning throttle valve control unit - J338-
⇒ [page 118](#)

5 - 7 Nm

6 - Sealing ring

- ☐ replace if damaged

7 - Connecting hose

- ☐ for crankcase ventilation
- ☐ check for firm seating

8 - 7 Nm

- ☐ mounted up to 05/2005

9 - Connecting pipe

- ☐ for exhaust gas recirculation
- ☐ mounted up to 05/2005

10 - Sealing ring

- ☐ replace
- ☐ mounted up to 05/2005

11 - Intake manifold

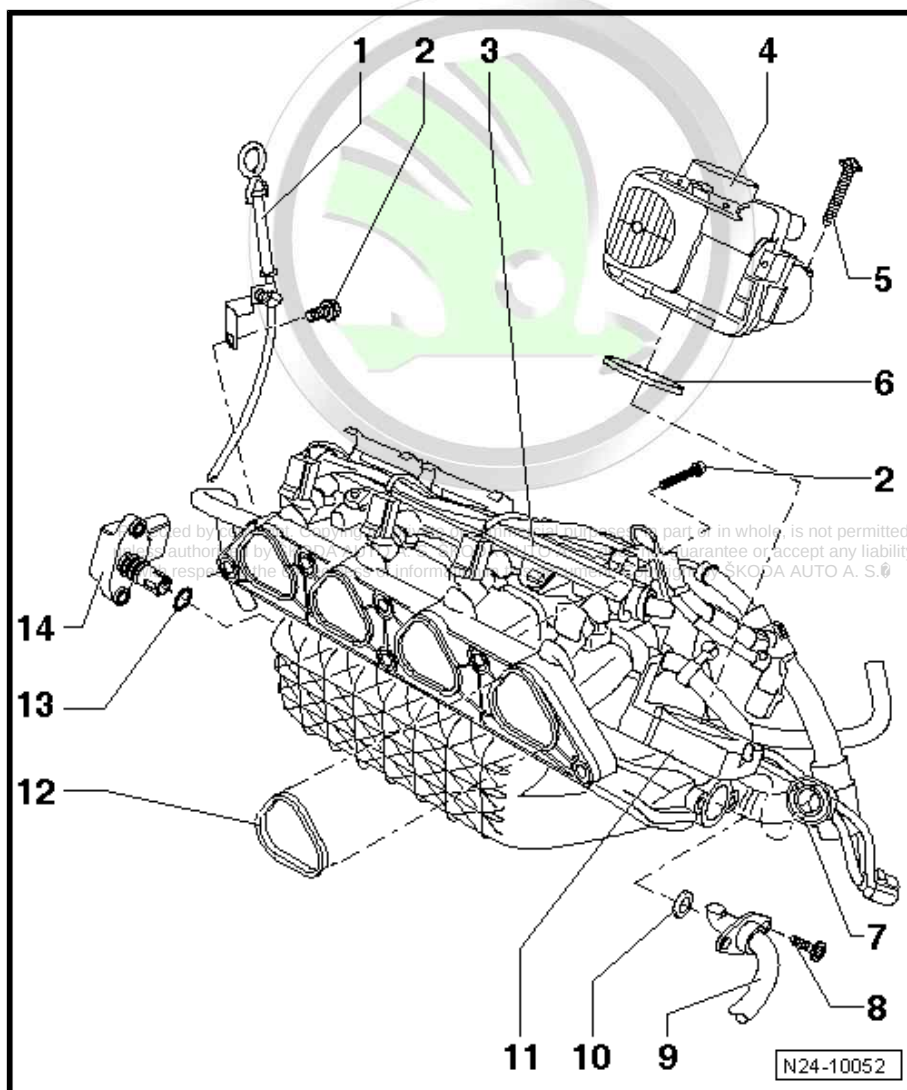
12 - Sealing ring

- ☐ replace

13 - O-ring

- ☐ replace if damaged

14 - Intake manifold pressure sender - G71- with intake air temperature sender - G42-





1.3 Intake manifold - Summary of components (for engine identification characters BUD, CGGA)

1 - Intake manifold

2 - Sealing ring

- ☐ replace

3 - 7 Nm

4 - Throttle valve control unit - J338-

- ☐ when replacing, adapt the engine control unit to the throttle valve control unit ⇒ Vehicle diagnostic tester
- ☐ Cleaning throttle valve control unit - J338-
⇒ [page 118](#)

5 - Breather hose

- ☐ from the activated charcoal filter system
⇒ [page 107](#)

6 - Solenoid valve 1 for activated charcoal filter - N80-

- ☐ attached with bracket to the intake manifold
- ☐ removing and installing
⇒ [page 107](#)

7 - Breather hose

8 - 20 Nm

9 - Vacuum hose

- ☐ To the brake servo unit

10 - O-ring

- ☐ replace if damaged

11 - Coolant hose

12 - Spring strap clamp

13 - Preheating for crankcase ventilation

- ☐ remove intake manifold for removing and installing

14 - 3 Nm

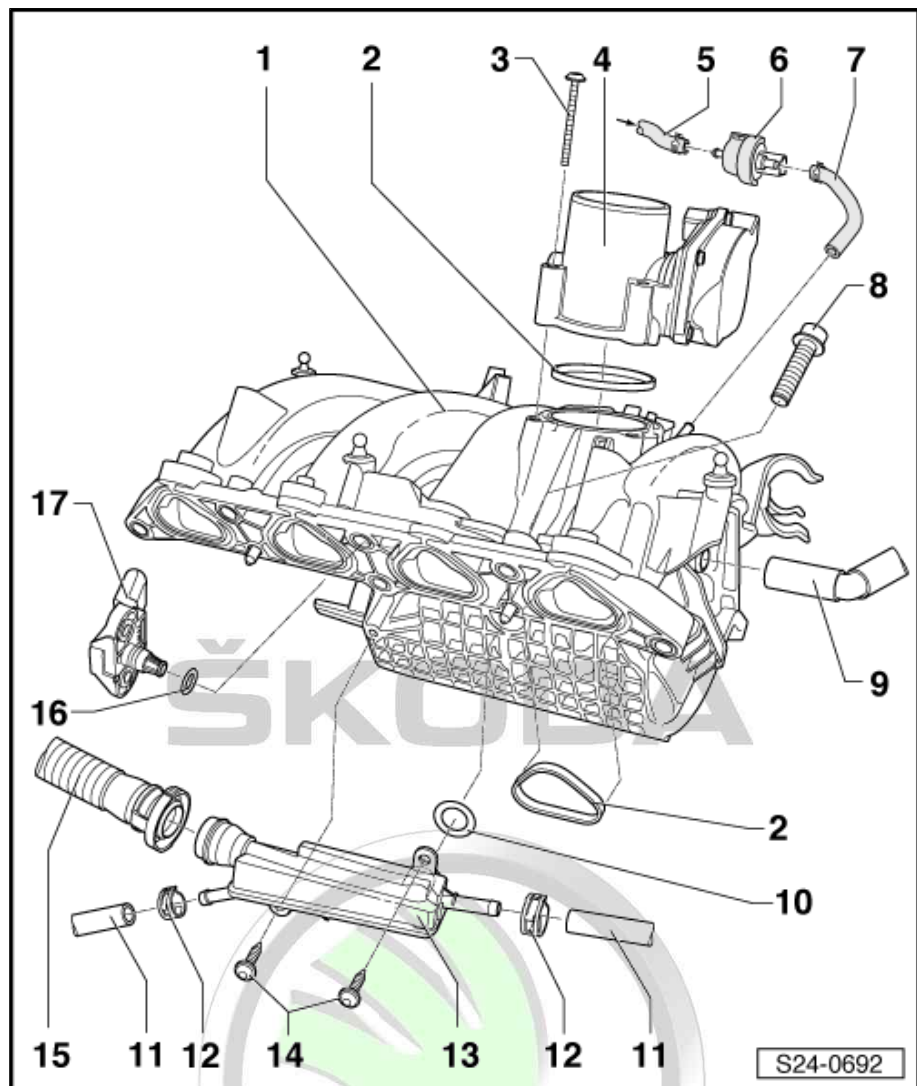
15 - Pipe section

- ☐ to vacuum regulating valve for crankcase ventilation (for oil separator) ⇒ [page 59](#)

16 - O-ring

- ☐ replace

17 - Intake manifold pressure sender - G71- with intake air temperature sender - G42-



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1.4 Fuel rail with injection valves - Summary of components

1 - Feed line

- ☐ check for firm seating
- ☐ secure with spring strap clamps
- ☐ from fuel tank

2 - 7 Nm

3 - Retaining clip

- ☐ Pay attention to version

4 - Guide

- ☐ clipped on to fuel rail

5 - Fuel distributor

6 - Vent valve

- ☐ for fuel system
- ☐ Vent fuel system
⇒ [page 101](#)

7 - Cap

- ☐ for vent valve

8 - Retaining clip

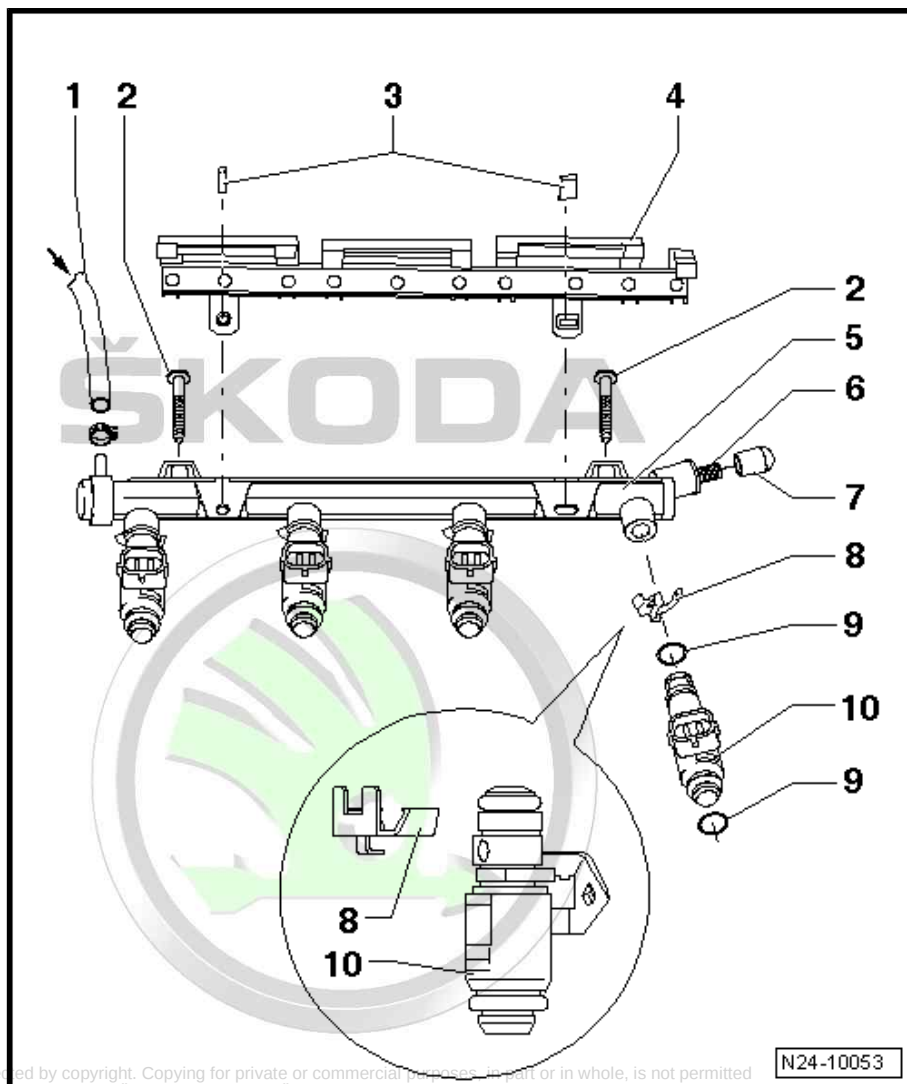
- ☐ check for correct fit on injection valve

9 - O-ring

- ☐ replace
- ☐ before fitting moisten lightly with clean engine oil

10 - Injector -N30...N33-

- ☐ Check the injection rate and tightness of the injection valve
⇒ [page 119](#)
- ☐ removing and installing ⇒ [page 116](#)

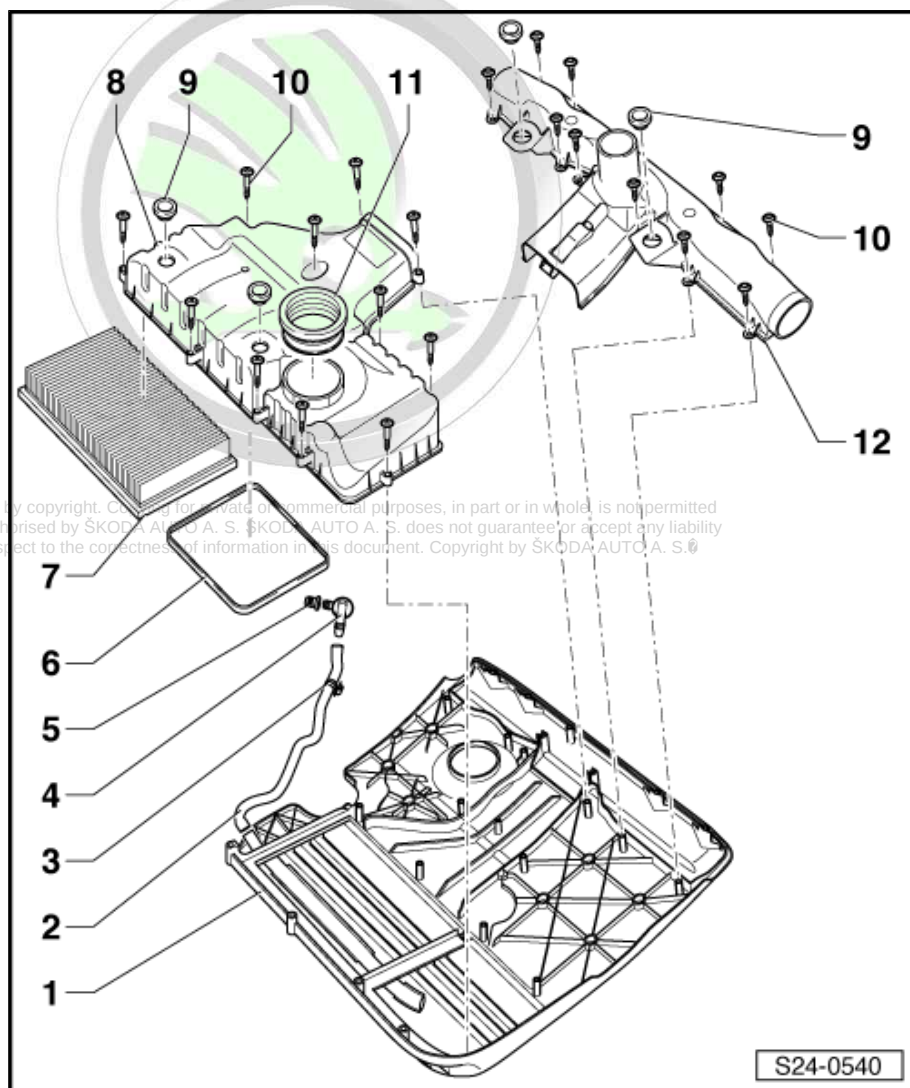


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N24-10053

1.5 Air filter - Summary of components (for engine identification characters BCA)

- 1 - Air filter top part
- 2 - Connecting hose
- 3 - Retaining clip
- 4 - Non-return valve
- 5 - Grommet
 - ☐ replace if damaged
- 6 - Gasket
 - ☐ replace if damaged
- 7 - Filter element
- 8 - Air filter bottom part
- 9 - Rubber holder
- 10 - 3 Nm
- 11 - Sealing ring
 - ☐ check for firm seating
 - ☐ replace if damaged
- 12 - Inlet connection with control flap
 - ☐ Testing intake manifold preheating ⇒ [page 119](#)



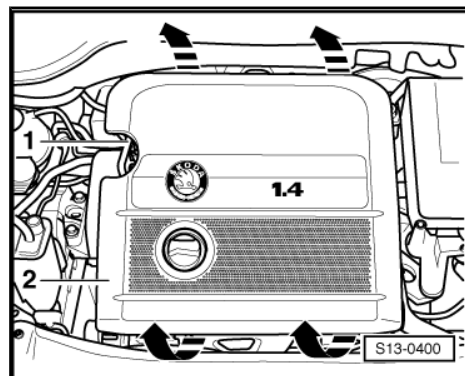
1.6 Removing engine cover with air filter (for engine identification characters BCA)

Removing

- Pull off hose -1- and remove engine cover -2- with air filter upwards -arrows-.

Install

- Installation is carried out in the reverse order.



1.7 Air filter - Summary of components (for engine identification characters BUD, CGGA)

1 - 3 Nm

2 - Air filter top part

3 - Sealing ring

4 - Non-return valve

5 - Hose

□ to camshaft housing

6 - Air intake hose

□ with inlet connection

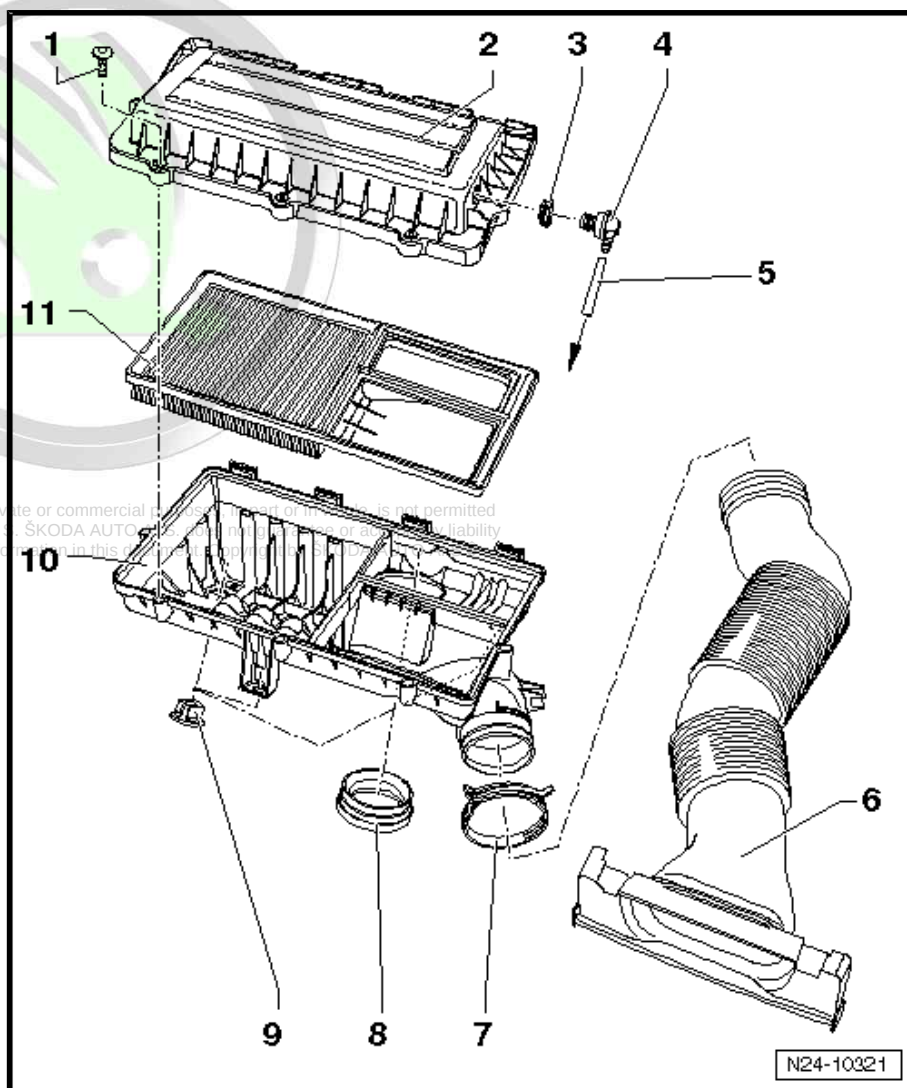
7 - Spring strap clamp

8 - Sealing ring

9 - Rubber grommet

10 - Air filter bottom part

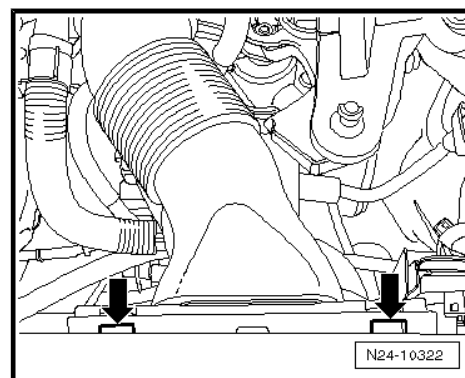
11 - Air filter element



1.8 Removing and installing air filter housing (for engine identification characters BUD, CGGA)

Removing

- Press the catches -arrows- and pull the inlet connection out of the intake air duct.

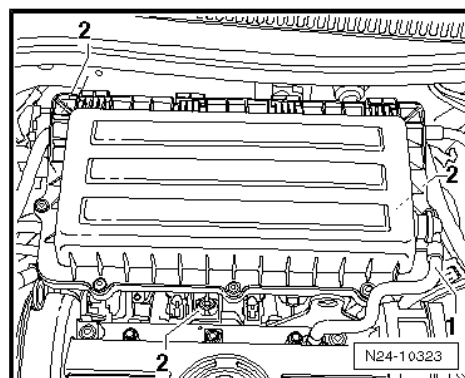
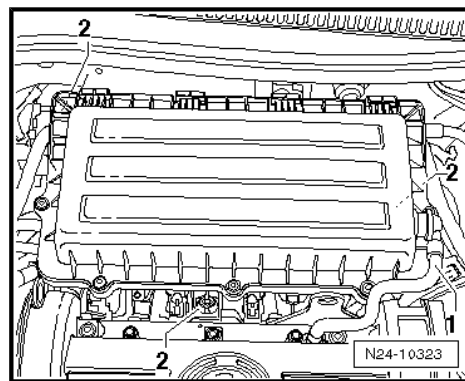




- Pull off hose -1- from non-return valve.
- Detach the air filter housing from the carrier bolts -2- upwards.

Install

- Installation is carried out in the reverse order.
- Press the air filter housing from the top onto the carrier bolts -2-.
- Fit the hose -1- onto the non-return valve.



1.9 Removing and installing injection valves

Removing

- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.
- Disconnect the plug -arrow- from the fuel delivery unit.



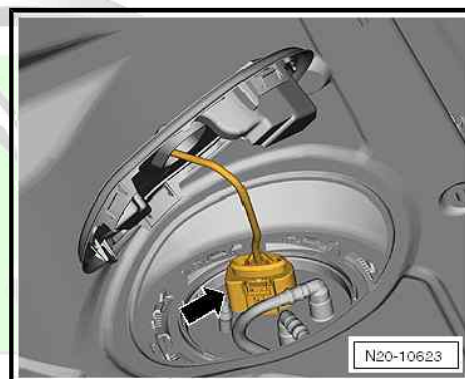
Note

When disconnecting the plug, the voltage supply of the fuel delivery unit is interrupted for reasons of safety otherwise the fuel pump would start running while opening the driver's door.

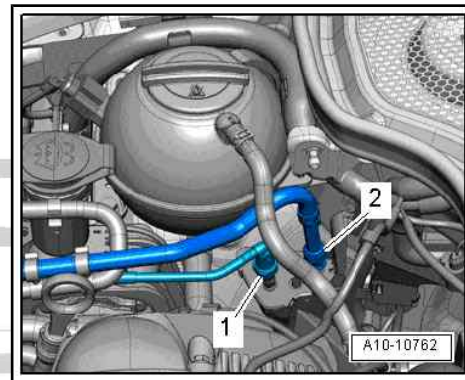


WARNING

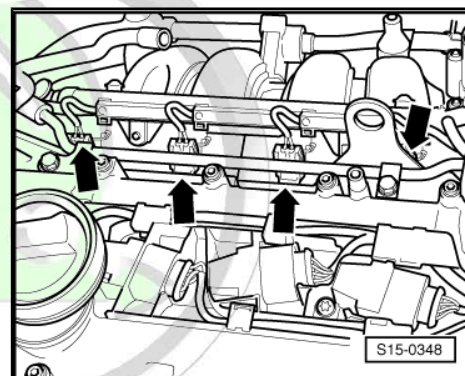
The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.



- Remove the feed line -2- (press in the securing ring to the top) and catch the fuel which flows out with a cleaning cloth.
- Remove air filter housing:
- ◆ Engine identification characters BCA ➤ [page 114](#)
- ◆ Engine identification characters BUD, CGGA ➤ [page 115](#)



- Disconnect plug -arrows- of all injection valves.
- Release the wiring loom of the injection valves.
- Unscrew the fuel distributor from the intake manifold.
- Remove the fuel distributor with injectors from the inlet manifold. (Hose remains connected).

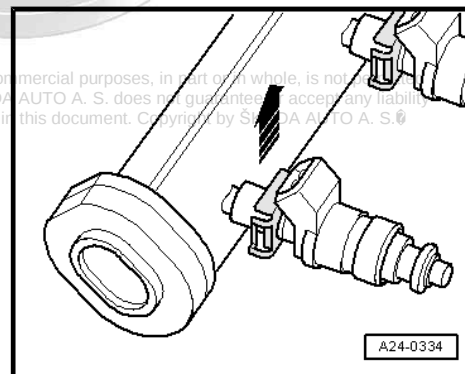


- Detach clamp -arrow- and remove injection valve.

Install

The installation of the injection valves occurs in reverse order, while doing so pay attention to the following points:

- ◆ Replace the O-rings on all the injectors and moisten lightly with clean engine oil.
- ◆ Check perfect fit of the clamps.
- ◆ Fit the fuel rail with the installed injection valves to the intake manifold and tighten screws uniformly to 7 Nm.
- Venting air from the fuel system ➤ [page 101](#) .

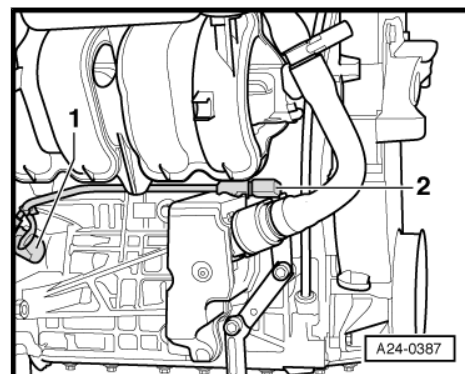


1.10 Removing and installing engine speed sender - G28-

The engine speed sender -G28- is a speed and reference marking sender. If the speed signal fails with the engine running this could result in an engine stoppage.

Removing

- Remove 3-pin connector -1- where necessary -2- (depending on the model) of the engine speed sender - G28- The plug is accessible from below.



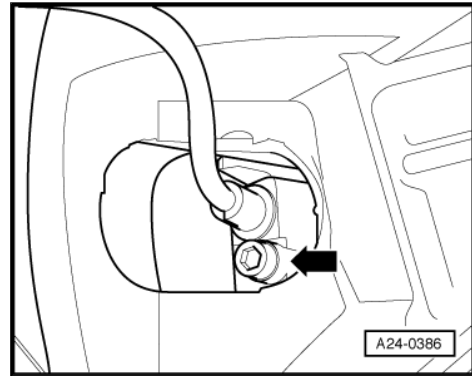


- Remove fixing screw -arrow- and take off engine speed sender - G28- .

Install

Installation is performed in the reverse order, pay attention to the following points:

- ◆ When changing the sender, pay attention to the part number of the engine speed sender - G28- .
- ◆ Tightening torque: 5 Nm



1.11 Clean throttle valve control unit - J338-



Note

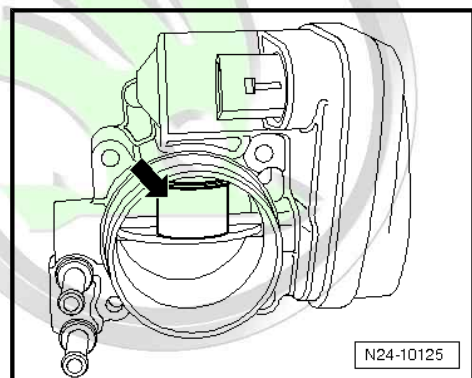
- ◆ If a new engine control unit - J623- is fitted, the throttle valve control unit - J338- must be adapted. The adaptation must only be carried out with a new or cleaned throttle valve control unit - J338- . Dirt/carbon deposits in the end stop of the throttle valve can lead to incorrect adaptation values.
- ◆ The throttle valve support must not be scratched when cleaning.

- Remove air filter housing:
- ◆ Engine identification characters BCA ➔ [page 114](#)
- ◆ Engine identification characters BUD, CGGA ➔ [page 115](#)
- Remove throttle valve control unit - J338- ➔ [page 112](#) .
- Open throttle valve by hand and lock in open position using a suitable object (e.g. wood or plastic wedge) -arrow-.

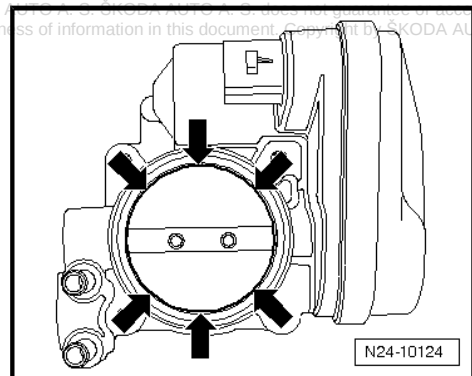


WARNING

Acetone is easily inflammable. Observe the accident prevention regulations and the safety instructions when handling easily inflammable fluids. Do not use compressed air when cleaning the throttle valve. Wear safety goggles and safety clothing, in order to avoid injuries and skin contact with fuel.



- Thoroughly clean the throttle valve support, in particular the area of the closed throttle valve -arrows-, with commercially available acetone in accordance with DIN 53247 and a paint brush.
- Wipe the throttle valve support with a fluffy cloth.
- Let the acetone dry off completely and re-install the cleaned throttle valve control unit - J338- .
- Adapting the engine control unit - J623- to the throttle valve control unit - J338- ➔ Vehicle diagnostic tester.



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2 Testing components



Note

- ◆ Observe safety measures ⇒ [page 2](#).
- ◆ Observe rules for cleanliness ⇒ [page 2](#).

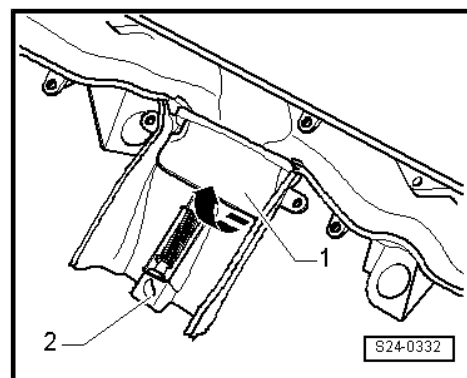
2.1 Checking the intake manifold preheating (only for engine identification characters BCA)

Special tools and workshop equipment required

- ◆ Refrigerant spray (commercially available)

Testing control flap

- Remove engine cover with air filter ⇒ [page 114](#).
- Check position of the regulating flap -1-.
- Spray thermo-element -2- with refrigerant spray.
- ◆ Above +23°C the flap must close the hot air connection
- ◆ Below +10 °C the flap opens the hot air connection



2.2 Checking the tightness and injection rate of the injection valves

Special tools and workshop equipment required

- ◆ Remote control, e.g. - V.A.G 1348/3 A-
- ◆ Adapter cable, e.g. - V.A.G 1348/3-2-
- ◆ Measuring glasses, e.g. - V.A.G 1602-
- ◆ Measuring tool set, e.g. - V.A.G 1594 C-

2.2.1 Leak check



WARNING

The fuel system is under pressure! Before opening the system lay cleaning cloths around the connection point. Reduce pressure by carefully releasing the connection point.

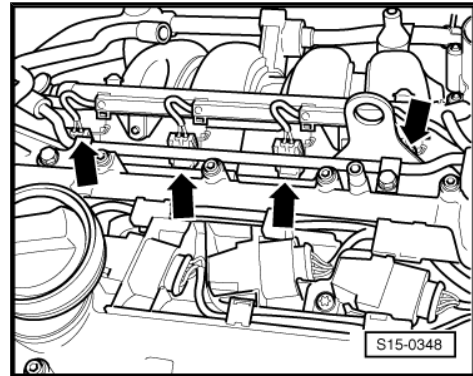
Test condition

- The fuel pressure must be OK, test ⇒ [page 99](#)
- Remove air filter housing:
- ◆ Engine identification characters BCA ⇒ [page 114](#)
- ◆ Engine identification characters BUD, CGGA ⇒ [page 115](#)

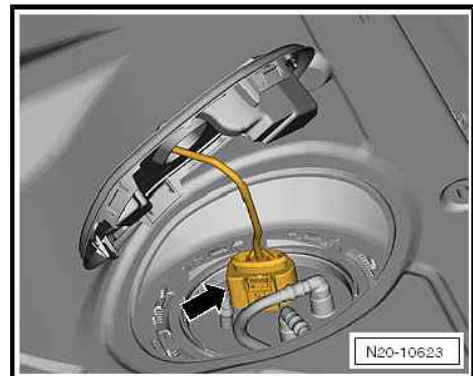
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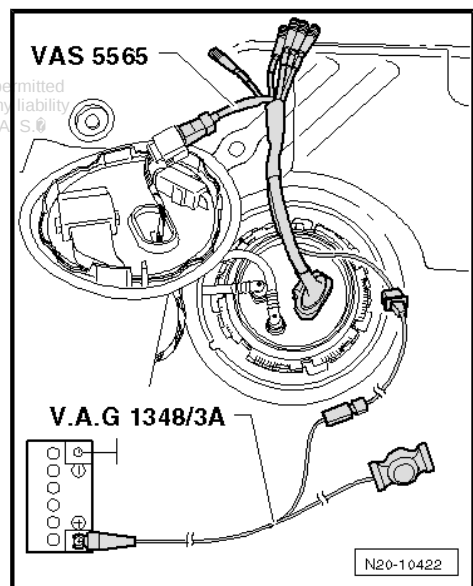
- Disconnect plug -arrows- of all injection valves.
- Release the wiring loom of the injection valves.
- Unscrew the fuel distributor from the intake manifold.
- Remove the fuel distributor with injectors from the inlet manifold. (Hose remains connected).
- Removing rear seat bench ➔ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



- Disconnect the plug -arrow- from the fuel delivery unit.



- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the remote control - V.A.G 1348/3A- to the adapter - VAS 5565- and to the battery positive (+).



Note

This step is only intended to ensure that the fuel delivery unit runs when the engine is switched off.

- Test the tightness of the injection valves (visual inspection). With the fuel delivery unit running, only 1 to 2 drops a minute should drip out at each valve.

If the fuel loss is greater than this:

- Replace the leaky injector ➔ [page 116](#) .



Note

Always fit new seals.

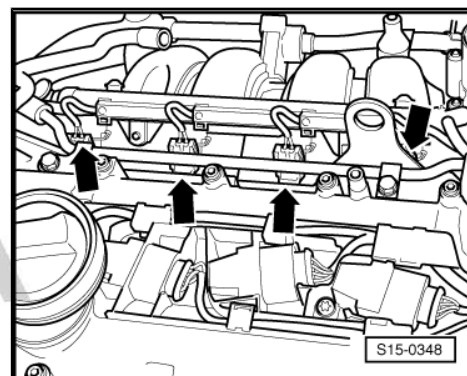
2.2.2 Testing injection rate

Test conditions:

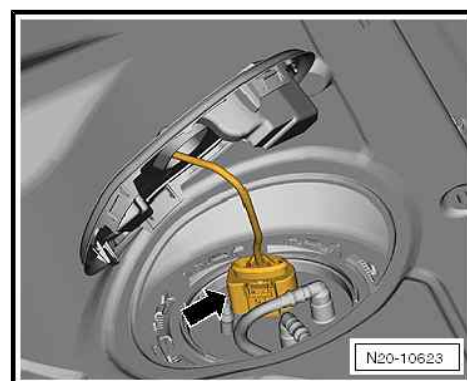
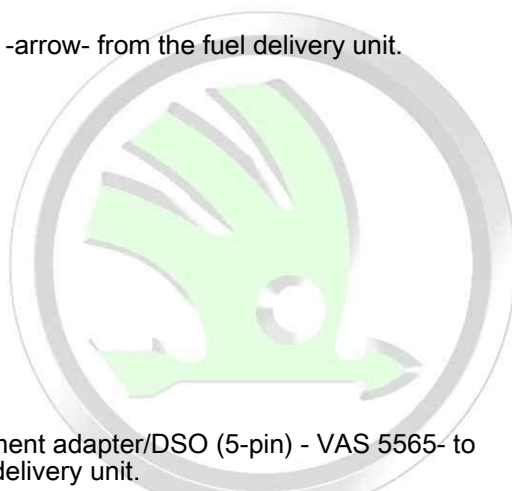
- The fuel pressure must be OK, test ➔ [page 99](#)
- Injection valves installed in the fuel rail and fuel line connected
- Fuel temperature 15...20°C, fuel must according to the valid standards
- Remove air filter housing:
- ♦ Engine identification characters BCA ➔ [page 114](#)

◆ Engine identification characters BUD, CGGA ⇒ [page 115](#)

- Disconnect plug -arrows- of all injection valves.
- Release the wiring loom of the injection valves.
- Unscrew the fuel distributor from the intake manifold.
- Remove the fuel distributor with injectors from the inlet manifold. (Hose remains connected).
- Removing rear seat bench ⇒ Body Work; Rep. gr. 72 .
- Remove the cover from the fuel delivery unit.



- Disconnect the plug -arrow- from the fuel delivery unit.



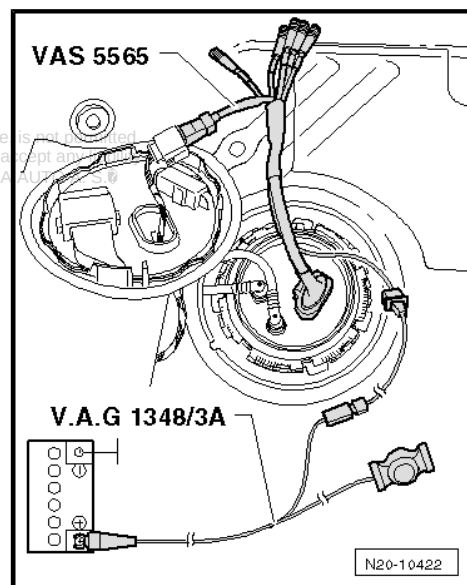
- Connect test instrument adapter/DSO (5-pin) - VAS 5565- to connector and fuel delivery unit.
- Connect the remote control - V.A.G 1348/3A- to the adapter - VAS 5565- and to the battery positive (+).



Note

This step is only intended to ensure that the fuel delivery unit runs when the engine is switched off.

- Insert injector to be tested in a measuring glass, e.g. - V.A.G 1602- .





- Connect a contact of the injection valve on the engine mass using adapter cables from the measuring tool set .
- Connect the other contact of the injection valve using adapter cables to the remote control, e.g. - V.A.G 1348/3 A- with the adapter cable, e.g. - V.A.G 1348/3-2- .
- Connect alligator clip to the battery (+).



Note

When testing the injection rate also check the jet formation.

- Activate the remote control - V.A.G 1348/3 A- for 30 seconds.
- Repeat test at the other injectors. While doing so use a new measuring glasses.
- After all the injectors have been operated, place the measuring glasses on a flat surface and compare the quantities of fuel injected.



Note

The jet must be the same for all injection valves.

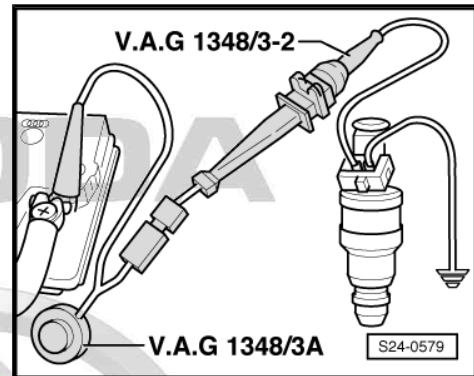
Specified value: 56 ... 65 ml per valve.

If the measurement obtained for one or several injectors is below or above the specification:

- Replace the faulty injector ➤ [page 116](#) .

The installation of the injection valves occurs in reverse order, while doing so pay attention to the following points:

- ◆ Replace the O-rings on all the injectors and moisten lightly with clean engine oil.
- ◆ Fit the fuel rail with the installed injection valves to the intake manifold and tighten screws uniformly to 7 Nm.



3 Engine control unit

3.1 Removing and installing engine control unit



Note

- ◆ In order to be able to unplug the connector from the control unit, the control unit must always be removed.
- ◆ The learning values are erased when the plug is removed from the engine control unit, the event memory contents are retained.
- ◆ If the engine control unit is replaced, the vehicle diagnosis, measurement and information system - VAS 5051- must be connected and the function "replace engine control unit" must be carried out.
- ◆ If the engine control unit is replaced, the throttle valve control unit - J338- must be cleaned before the adaptation
⇒ [page 118](#) .

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Special tools and workshop equipment required

- ◆ Body saw e.g. - V.A.G 1523 A-

Removing

- Switch off ignition.
- Remove the cooling water tank cover ⇒ Body Work; Rep. gr. 66 .
- Remove bulkhead plenum chamber -arrows-.
- Removing windscreen wiper and washer system ⇒ Electrical System; Rep. gr. 92 .

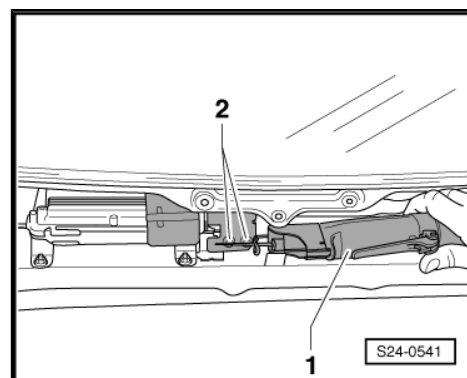
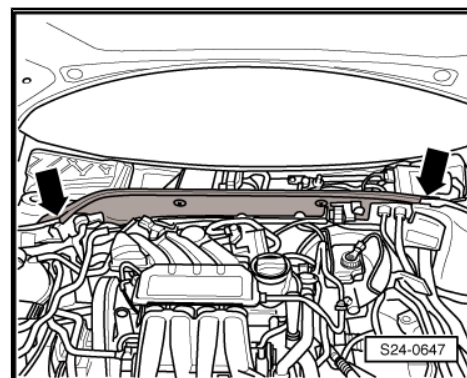
For vehicles with protective housing

- Cut with body saw -1- a slot for the cross-head screwdriver in the heads of the pull-off screws -2-.



Note

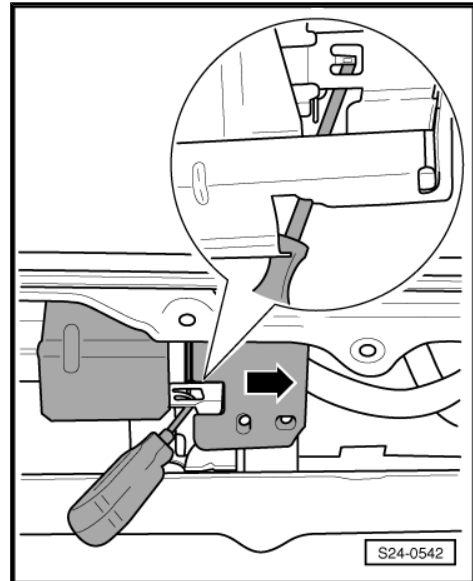
- ◆ It must be sawed twice with the body saw, so that the slot is wide enough, in order to be able to unscrew the screws with a suitable screwdriver.
- ◆ The pull-off screws until are inserted with locking agent.
- Screw out the screws.





- Lift locking tab of protective cover with a cross-head screw-driver.
- Push the protective cover in the -direction of the arrow- out of the bracket for engine control unit.

For all vehicles



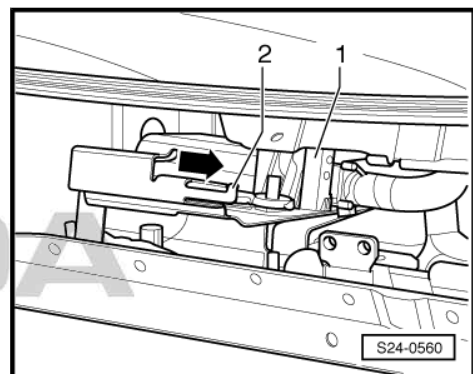
- Unlock retaining bracket -2-.
 - Push out engine control unit with plugs in -direction of arrow-.
- Disconnect plug at engine control unit and unplug.

Install



Note

For vehicles with protective cover, the metal swarfs must be suctioned out of the plenum chamber before installing the engine control unit.



- Connect both plugs and lock.
- Push engine control unit into the bracket and lock with retaining bracket -2-.

For vehicles with protective housing

- Fasten protective cover with new pull-off screws (before tightening align the protective cover in such a way that it does not come into contact with the surrounding components)

For all vehicles

- Installing windscreen wiper and washer system ➔ Electrical System; Rep. gr. 92 .
- Install bulkhead plenum chamber and plenum chamber cover ➔ Body Work; Rep. gr. 66 .

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26 – Exhaust system

1 Removing and installing parts of the exhaust system

Note

- ◆ After performing installation work on the exhaust system, make sure the exhaust system is not mounted under tension and has adequate clearance from the vehicle body. If necessary slacken the double clamp and align the exhaust pipe so as to create adequate clearance between all components and the vehicle body, and that the weight of the exhaust system is evenly distributed over the hangers.
- ◆ Always replace self-locking nuts.

1.1 Exhaust manifold and pre-exhaust pipe with catalytic converters - Summary of components (for engine identification characters BCA)

1 - Hot air collector/heat shield

2 - 10 Nm

3 - Exhaust manifold

4 - Gasket

- ☐ replace

5 - 25 Nm

- ☐ replace
- ☐ Coat stud bolts of exhaust manifold with hot bolt paste "G 052 112 A3"

6 - 40 Nm

- ☐ replace
- ☐ Coat stud bolts of exhaust pipe with hot bolt paste "G 052 112 A3"

7 - Clamping sleeve, 23 Nm

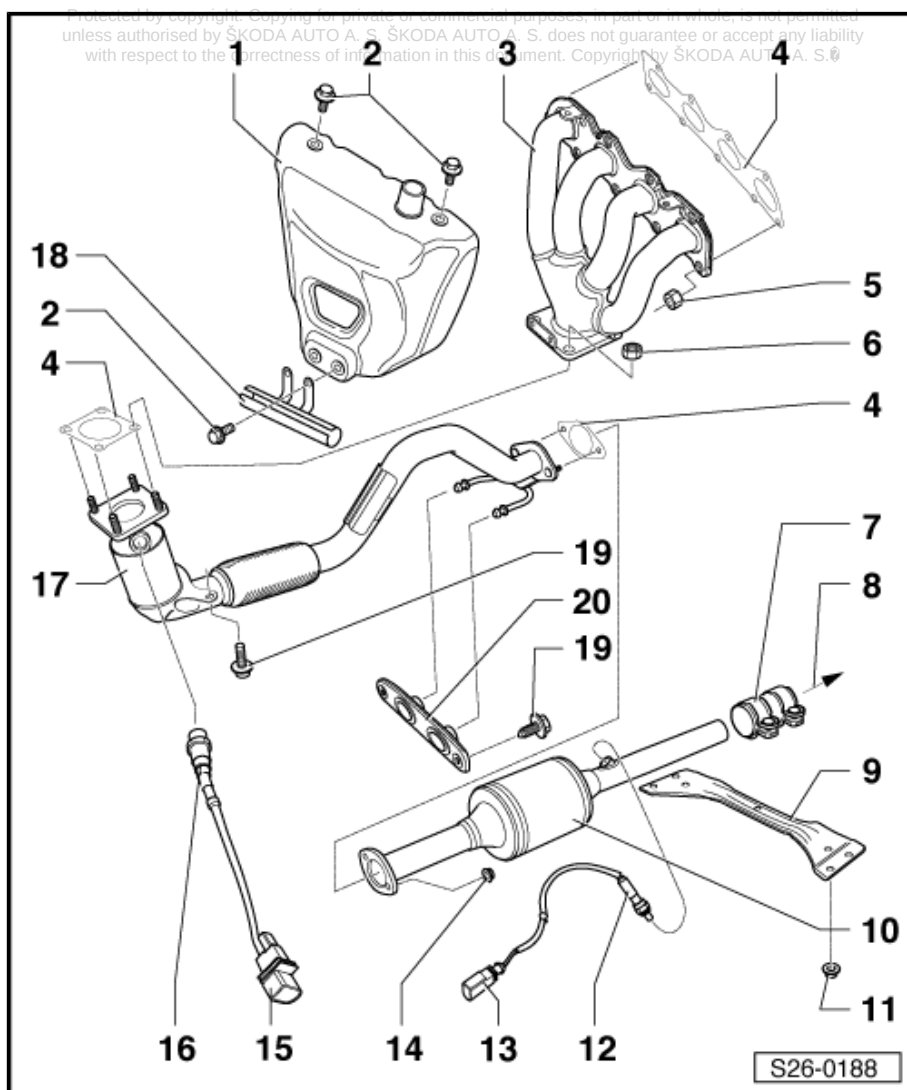
- ☐ Before tightening, align the exhaust system in cold condition free of stress ⇒ [page 129](#)
- ☐ Fitting position: The ends of the screw must not extend beyond the lower edge of the clamping sleeve, the screw fitting must face the left.
- ☐ Tighten bolted connections evenly

8 - to front silencer

9 - Front tunnel bridge

10 - Catalytic converter

- ☐ protect against shocks and blows





11 - 23 Nm

12 - Lambda probe downstream of catalytic converter - G130- , 50 Nm

- ☐ only coat the thread with hot screw paste - G 052 112 A3- ; the paste must not get into the slot of the probe body

13 - Connector

- ☐ 4-pin
- ☐ for lambda probe downstream of catalytic converter - G130-
- ☐ Connector is located on the underbody under the cover on the right side

14 - 25 Nm

- ☐ replace

15 - Connector

- ☐ 6-pin
- ☐ for lambda probe upstream of catalytic converter -G39-

16 - Lambda probe - G39- , 50 Nm

- ☐ only coat the thread with hot screw paste - G 052 112 A3- ; the paste must not get into the slot of the probe body

17 - Pre-catalytic converter with exhaust pipe

- ☐ protect against shocks and blows
- ☐ do not twist decoupling element more than 10° - risk of damage
- ☐ If the pre-exhaust pipe should be reinstalled, the transport security - T10403- must be secured to the decoupling element against over-tensioning and bending.

18 - Bracket for wiring loom

19 - 25 Nm

20 - Hanger

- ☐ replace if damaged

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1.2 Exhaust manifold and pre-exhaust pipe with catalytic converters - Summary of components (for engine identification characters BUD, CGGA)

1 - Hot air collector/heat shield

2 - 10 Nm

3 - Lambda probe - G39- , 50 Nm

- ☐ only coat the thread with hot screw paste - G 052 112 A3- ; the paste must not get into the slot of the probe body

4 - Exhaust manifold with pre-catalytic converter

5 - Gasket

- ☐ replace

6 - 25 Nm

- ☐ replace

7 - Hanger

8 - 25 Nm

9 - Clamping sleeve, 23 Nm

- ☐ Before tightening, align the exhaust system in cold condition free of stress ➔ [page 129](#)
- ☐ Fitting position: The ends of the screw must not extend beyond the lower edge of the clamping sleeve, the screw fitting must face the left.
- ☐ Tighten bolted connections evenly

10 - to front silencer

11 - Front tunnel bridge

12 - Catalytic converter

- ☐ protect against shocks and blows

13 - 23 Nm

14 - Lambda probe downstream of catalytic converter - G130- , 50 Nm

- ☐ only coat the thread with hot screw paste - G 052 112 A3- ; the paste must not get into the slot of the probe body

15 - Connector

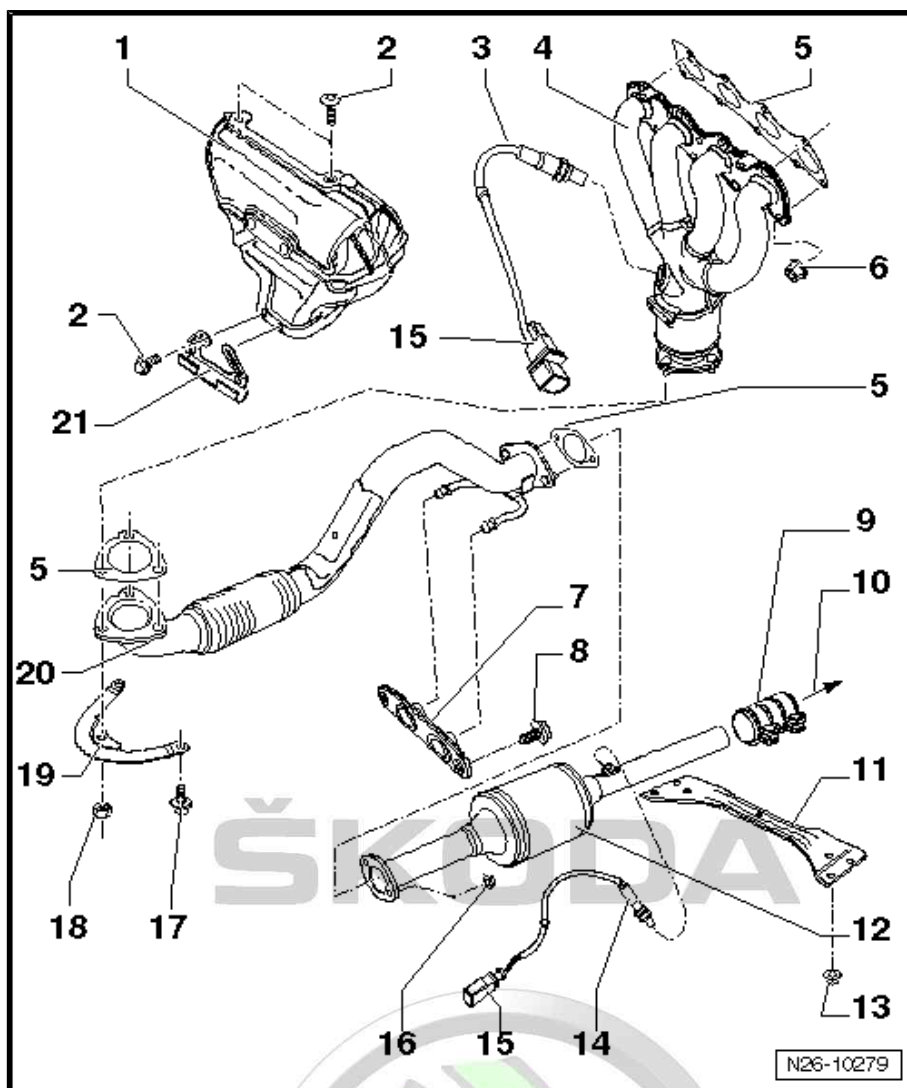
- ☐ 4-pin
- ☐ for lambda probe downstream of catalytic converter - G130-
- ☐ Connector is located on the underbody under the cover on the right side

16 - 25 Nm

17 - 20 Nm

18 - 40 Nm

- ☐ replace



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19 - Support

20 - Exhaust pipe

- ☐ do not twist decoupling element more than 10° - risk of damage
- ☐ If the pre-exhaust pipe should be reinstalled, the transport security - T10403- must be secured to the decoupling element against over-tensioning and bending.

21 - Cable guide

1.3 Middle or rear part of the exhaust system - Summary of components

1 - Hanger

2 - 23 Nm

3 - Retaining strap

- ☐ replace if damaged

4 - Clamping sleeve

- ☐ for replacing the middle or rear silencer
- ☐ Fitting position: The end of the screw must not extend beyond the lower edge of the clamping sleeve, the screw fitting must face the right.
- ☐ Tighten screwed connections uniformly

5 - Rear silencer

- ☐ for first equipment building unit with middle silencer. Replace individually when carrying out repairs
- ☐ Separation point
⇒ [page 128](#)
- ☐ Align exhaust system free of stress
⇒ [page 129](#)

6 - 23 Nm

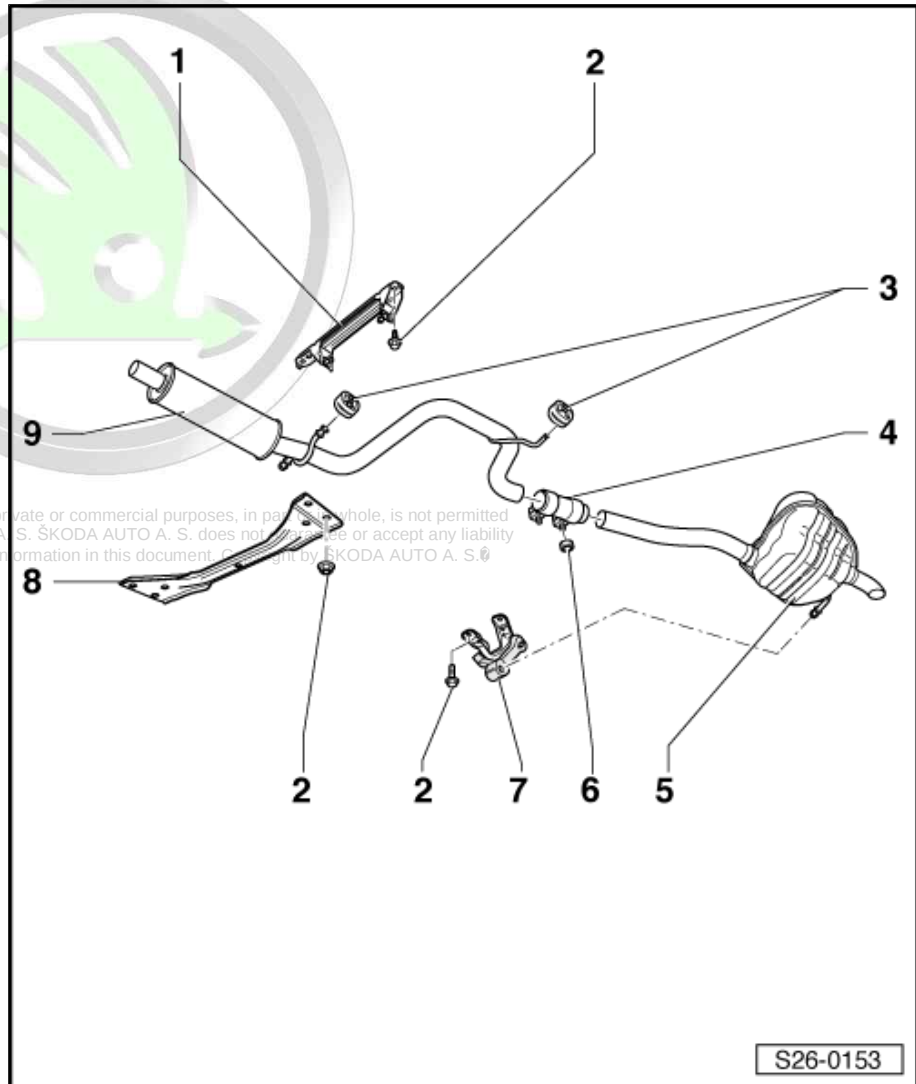
7 - Hanger

- ☐ replace if damaged

8 - Rear tunnel bridge

9 - The middle silencer

- ☐ for first equipment building unit with rear silencer. Replace individually when carrying out repairs
- ☐ Separation point ⇒ [page 128](#)
- ☐ Align exhaust system free of stress ⇒ [page 129](#)



1.4 Replacing middle or rear part of the exhaust system

- ◆ A separation point is provided at the exhaust pipe for replacing the middle silencer or the rear silencer.

- ◆ The separation point is marked by indentations on the circumference of the exhaust pipe.

Special tools and workshop equipment required

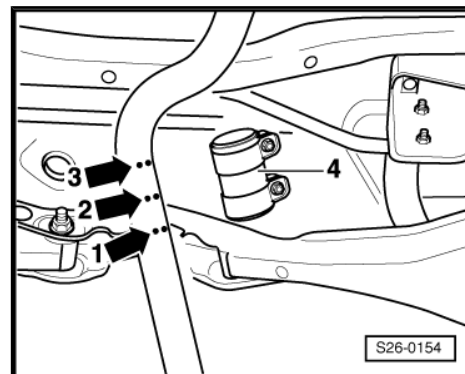
- ◆ Body saw, e.g. - V.A.G 1523 A-
- ◆ Protective goggles



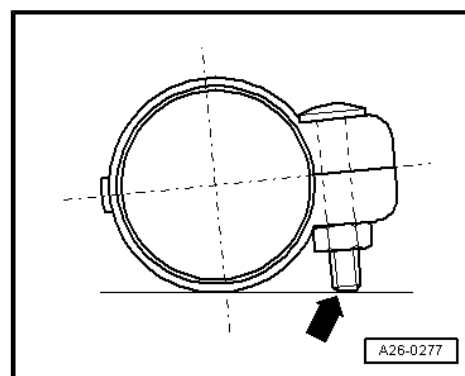
WARNING

Wear safety goggles.

- Cut exhaust pipe at right angles at the separation point -arrow 2-.
- When installing, position rear double clamp -4- at the side markings -arrow 1- and -arrow 3-.



- Turn rear clamping sleeve in such a way that the ends of the screws do not protrude beyond the bottom edge of the clamping sleeve -arrow-.
- Align rear silencer horizontally and tighten rear clamping sleeve to 23 Nm.
- Align exhaust system in cold condition free of stress
⇒ [page 129](#).

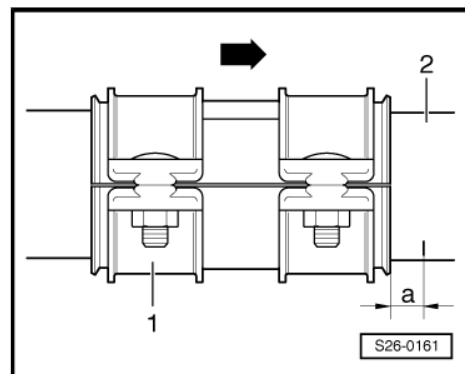


1.5 Aligning exhaust system free of stress

- The exhaust system is aligned when cold.
- Slacken bolted connections on the front clamping sleeve -1-.
- Position the front clamping sleeve -1- on the pre-exhaust pipe -2- at a distance -a- = 5 mm from the marking (the -arrow-points in direction of travel).

The fixing screws must be located on the right. The screws must not protrude beyond the bottom edge of the clamping sleeve.

- Tighten front bolted connection slightly.



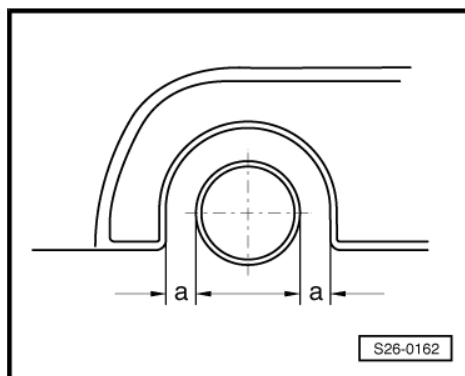
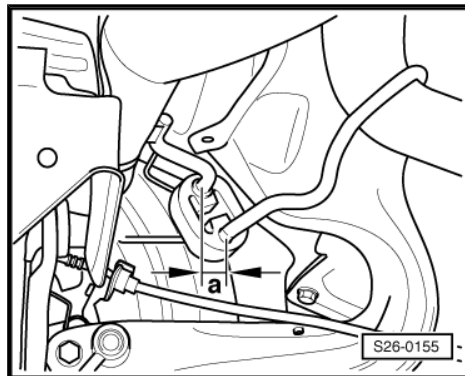


- Push middle and rear silencer sufficiently far forward into the clamping sleeve until pretension dimension -a- between hanger of body and hanger of middle silencer amounts to 9...11 mm.
- Tighten screwed connections of the front clamping sleeve evenly to 23 Nm.

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Align exhaust tailpipe

- Align rear silencer in such a way that there is an equal distance -a- between bumper opening and exhaust tailpipe.
- For centering the exhaust tailpipe, if necessary loosen the suspension of the rear silencer.



1.6 Inspecting the exhaust system for leak-tightness

- Start engine and run in idle.
- Seal off exhaust tailpipe for the duration of the leak check (e.g. with cloths or plugs).
- All connection points: Inspect cylinder head/exhaust manifold, exhaust manifold/pre-exhaust pipe etc. for leak tightness by listening.
- Eliminate any leak found.

2 Exhaust gas recirculation system

2.1 Exhaust gas recirculation - Summary of components (for engine identification characters BCA up to 05/2005)

1 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

- ☐ when replacing, erase initialisation values and re-adapt engine control unit ➔ Vehicle diagnostic tester

2 - Gasket

- ☐ replace

3 - Flange

- ☐ between exhaust gas recirculation valve and cylinder head

4 - 20 Nm

5 - Sealing ring

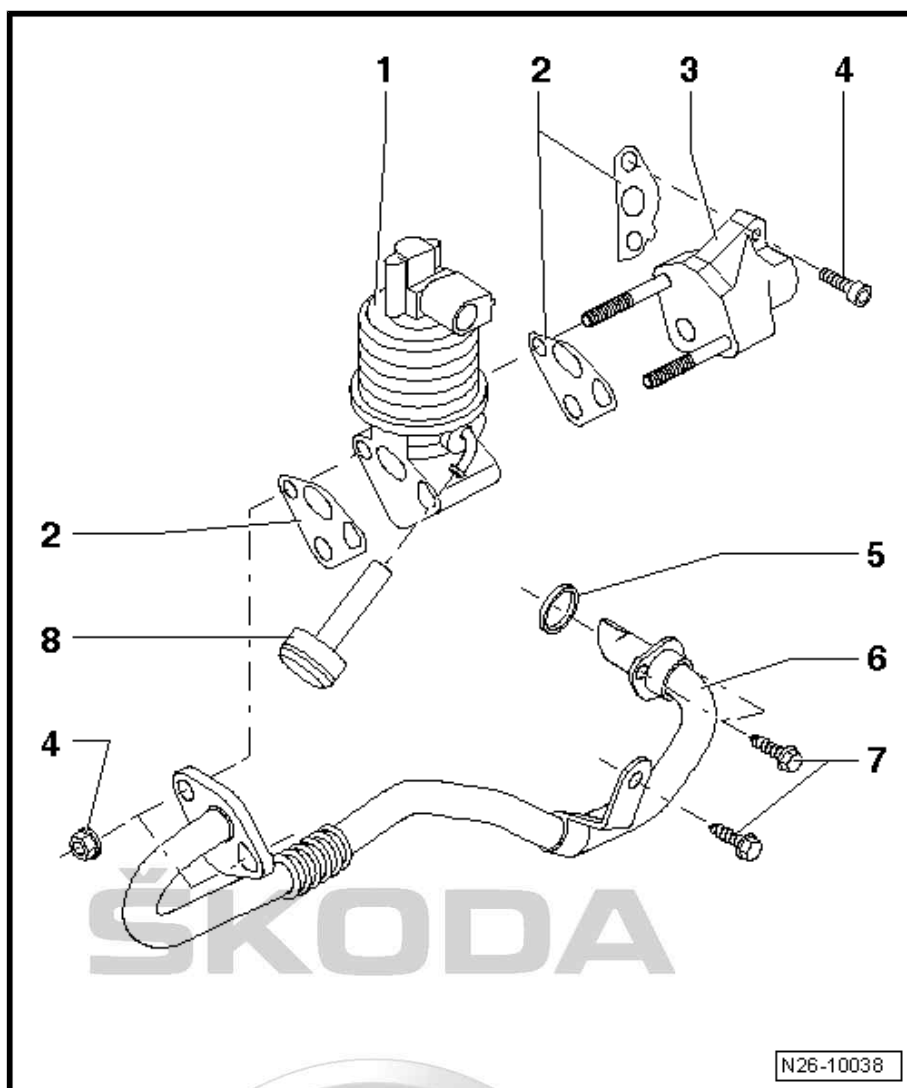
- ☐ replace

6 - Connecting pipe

- ☐ To intake manifold
- ☐ screw free of stress

7 - 7 Nm

8 - Filter



28 – Ignition system

1 Ignition system

General notes on the ignition system ⇒ [page 4](#) .

1.1 Ignition system - Summary of components

1 - Connector

- ❑ black, 4 pin

2 - Ignition coil with a power output stage -(N70, N127, N291, N292)-

- ❑ removing and installing
⇒ [page 132](#)

3 - Connector

- ❑ black, 2 pin
- ❑ for knock sensor 1 - G61-
- ❑ contacts gold-plated

4 - Knock sensor 1 -G61-

- ❑ Contacts of connector gold-plated

5 - 20 Nm

- ❑ The tightening torque influences the knock sensor function

6 - Connector

- ❑ black, 3 pin
- ❑ for hall sender -G40-

7 - Hall sender -G40-

8 - O-ring

- ❑ replace if damaged

9 - 10 Nm

10 - Spark plug, 30 Nm

- ❑ use spark plug wrench, e.g. - 3122 B- for removing and installing

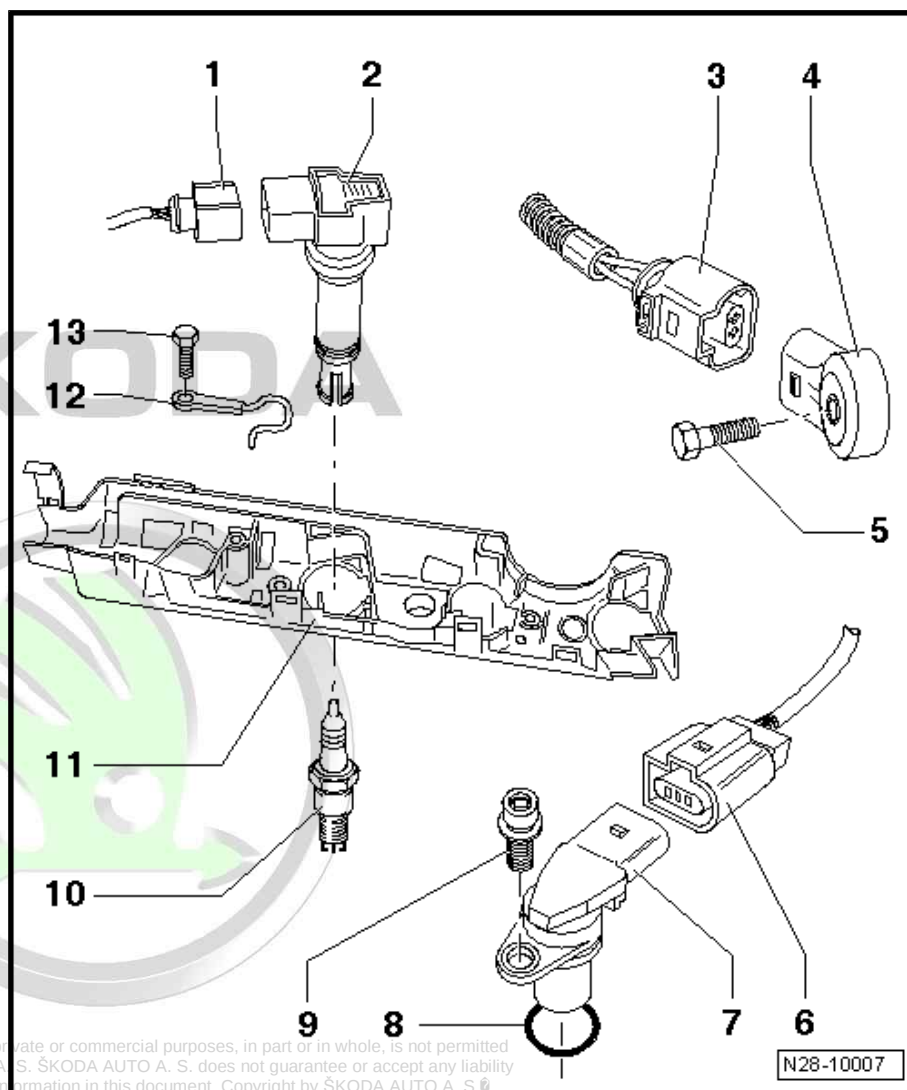
- ❑ Type and electrode spacing ⇒ Maintenance ; Booklet Octavia II.

11 - Guide

12 - Earth lead

13 - 10 Nm

- ❑ only loosen or tighten with the ignition off



1.2 Removing and installing ignition coils with power output stages

Special tools and workshop equipment required

- ◆ Assembly device - T10118-

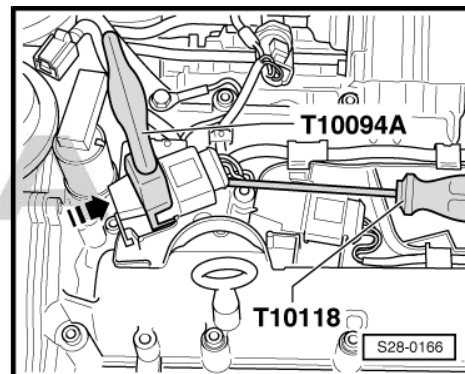
◆ Extractor - T10094A-

Removing

- Position extractor - T10094A- onto the ignition coil with power output stage in the -direction of the arrow-.
- Slightly pull out the ignition coil with power output stage.
- Position the assembly device - T10118- as shown.
- Carefully release the connector catch and unplug the connector.

Install

- Position extractor - T10094A- onto the ignition coil with power output stage.
- Loosely insert ignition coil in the cylinder head.
- Push connector onto the ignition coil with power output stage until it audibly locks into place.
- Press the ignition coil with power output stage with extractor - T10094A- onto the spark plug in the cylinder head.



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